Science Library FEB 19 1947

# JOURNAL OF MAMMALOGY

VOL. 28 FEBRUARY 1947 NO. 1

AMERICAN SOCIETY OF MAMMALOGISTS

# The American Society of Mammalogists

**Founded April 3, 1919**
**Incorporated April 29, 1920**


*Officers*

REMINGTON KELLOGG, *President*
RUDOLPH M. ANDERSON, *Vice-president*
SETH B. BENSON, *Recording Secretary*
EMMET T. HOOPER, *Corresponding Secretary*
VIOLA S. SHANTZ, *Treasurer*
WILLIAM B. DAVIS, *Chairman of Editorial Board*

*Additional Directors*

1945–1947

WILLIAM H. BURT
HAROLD J. COOLIDGE, JR.
J. KENNETH DOUTT
CLAUDE W. HIBBARD
G. H. H. TATE

1946–1948

VICTOR H. CAHALANE
E. C. CROSS
WILLIAM J. HAMILTON, JR.
J. ERIC HILL
ADOLPH MURIE

*Past-presidents*

WILFRED H. OSGOOD
HAROLD E. ANTHONY
H. H. T. JACKSON
WALTER P. TAYLOR
A. BRAZIER HOWELL
E. RAYMOND HALL

*Trustees*

HAROLD E. ANTHONY (1947) W. REID BLAIR (1948) WILLIAM K. GREGORY (1949)

*Standing Committees*

*Editorial:* William B. Davis, *Chairman*. Hartley H. T. Jackson, William L. Jellison, Otis Wade.

*Life Histories and Ecology:* Olaus J. Murie, *Chairman*. Alfred M. Bailey, W. Frank Blair, Edwin V. Komarek, Adolph Murie, Donald A. Spencer.

*Anatomy and Phylogeny:* D. Dwight Davis, *Chairman*. J. Eric Hill, H. Elizabeth Story, William L. Straus, Jr., George B. Wislocki, Horace E. Wood.

*Bibliography:* Gerrit S. Miller, Jr., *Chairman*. Emma Charters, David H. Johnson, Remington Kellogg.

*Marine Mammals:* Robert T. Orr, *Chairman*. J. Kenneth Doutt, Remington Kellogg, Jean M. Linsdale, Robert C. Miller, Victor B. Scheffer.

*Economic Mammalogy:* Edwin R. Kalmbach, *Chairman*. Rudolph M. Anderson, Charles Kendeigh, D. A. Spencer, Charles T. Vorhies, Tracey I. Storer.

*Conservation of Land Mammals:* Harold J. Coolidge, Jr., *Chairman*. Durwood L. Allen, Adrey E. Borell, J. Kenneth Doutt, E. Raymond Hall, Charles P. Lyman, Ralph S. Palmer, William G. Sheldon, Kenneth Stager.

*Nomenclature:* Wilfred H. Osgood, *Chairman*. Angel Cabrera, E. Raymond Hall, Remington Kellogg, Theodore S. Palmer, George Gaylord Simpson, George H. H. Tate.

*Membership:* Donald F. Hoffmeister, *Chairman*. Seth B. Benson, William L. Jellison, Randolph L. Peterson, Albert R. Shadle, Harley B. Sherman, Bernardo Villa R.

*Special Committee on Trapping Methods:* Wilford E. Sanderson, *Chairman*. Charles C. Adams, Edward A. Preble, Wesley A. Young.


## The Journal of Mammalogy

Subscription rates, $4.00 per year; single numbers, $1.00 each. Sent free to all members of the American Society of Mammalogists not in arrears for dues.

Subscriptions, changes of addresses, requests for missing numbers, applications for advertising rates, etc., should be addressed to the Corresponding Secretary, Emmet T. Hooper, Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

Publications for inclusion in the bibliography ("Recent Literature") of mammalogical literature should be sent to the Chairman of the Committee on Bibliography, Gerrit S. Miller, Jr., Division of Mammals, U. S. National Museum, Washington, D. C.

Manuscripts for publication, books for review and papers for special comment should be sent to the Chairman of the Editorial Committee, William B. Davis, Department of Fish and Game, College Station, Texas.


Journal of Mammalogy is published quarterly by the American Society of Mammalogists, Mt. Royal and Guilford Aves., Baltimore 2, Md. Entered as second class matter, November 22, 1919, at the Postoffice, Baltimore, Md., under the act of March 3, 1879.

*Made in United States of America*

G. W. Willett

# JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists

VOL. 28 FEBRUARY 15, 1947 No. 1


## GEORGE WILLETT: 1879–1945


BY KENNETH E. STAGER


In the passing of George Willett on August 2, 1945, zoology lost one of its truly great men and America one of her most loyal sons. Although George Willett was primarily an ornithologist, his knowledge and contributions in other fields of zoology were great. Whether his investigations were in ornithology, conchology, or mammalogy, his findings are respected and valued for their reliability and soundness, for he was a man of keen observation, conservative in judgment, and accurate to the minutest detail.

His greatness did not cease in the field of science, however, for he possessed a personality which unfortunately is the gift of far too few men. His understanding of his fellow man was vast indeed, and because of this he was loved and respected by all who enjoyed the privilege of calling him their friend.

George Willett always had a ready hand to help the coming young zoologist and especially was he the champion of the field collector. His sage advice to all beginning students of mammalogy or ornithology was to "get into the field and get acquainted with your subject at first hand; then come back to the laboratory or classroom and analyze the phenomena you have observed." He had little time for the strictly "armchair" zoologist and urged all his students to obtain field experience whenever and wherever the opportunity presented itself.

George Willett was born in Hawkesbury, Prescott County, Ontario, Canada, May 28, 1879, and was the first child of George and Hannah Willett. He attended grammar school and high school in Redlands and San Luis Obispo, California, and in the fall of 1894 entered Whittier Academy (later Whittier College). Throughout his early years he was, like many other naturalists of his time, an ardent bird egg collector, and the knowledge gained in this pursuit provided a foundation for his ornithological studies in the years that followed.

With the outbreak of the Spanish American War in 1898, George left his studies at Whittier College and enlisted in the army. As a private in the 35th U. S. Volunteer Infantry he spent considerable time in the Philippines, returning to the United States in 1902. While in the islands he had his first opportunity to become acquainted with the birds and mammals of the Old World. His regiment took an active part in the pursuit of the Aguinaldo Insurrectos and this duty took him deep into the interior of the island of Luzon. There were frequent periods

of relative inactivity and George exploited them to their fullest by collecting and observing local birds. He acquired a shotgun, as most ornithologists under similar circumstances somehow manage to do, and once so armed set about acquiring a small collection of the birds of Luzon. Many of the specimens he collected were new and strange to him, and because he did not have access to any ornithological literature, he was able to identify only a few of the species encountered. Though rats gnawed into the wooden trunk which contained his specimens, completely destroying all of the bird skins and eggs which he had so laboriously prepared, nothing could destroy his memory of the observations he had made, and these he was able to retain throughout the years of his life.

After returning to California in 1902 he accepted a position as recorder with the United States Geological Survey. This work took him into the remote areas of Arizona and Montana with a geological mapping crew, and here again when he was not obligated to attend to the work at hand he would be out observing and collecting birds and mammals of the region. The areas of Montana and Arizona in which he worked were abundant in new and varied forms of wildlife and George took advantage of every opportunity to become better acquainted with them.

In 1903 he returned to Los Angeles and accepted a position on the police force of that city. For many years he was a sergeant assigned to the old Chinatown area. Here he broadened his already vast understanding of that interesting mammal, his fellow man. Because of his deep understanding of human behavior, he became the fast friend and counselor of the Chinese colony of Los Angeles, and to show their appreciation of this friendship, the Chinese made him an honorary member of the Hop Sing Tong—an honor accorded to very few white men indeed!

In the summer of 1912, he accepted an assignment with the U. S. Biological Survey as reservation inspector. In this capacity he made several surveys of the bird life of various areas including portions of the western United States, Laysan Island, and Sitka, Alaska, continuing in this type of work until the outbreak of World War I.

His trip to Laysan Island in 1912, however, was in the interest of mammals, the mission being to help reduce the large numbers of rabbits which had multiplied on the island to such an extent that the native vegetation was threatened with complete destruction. Accompanying him on this trip was Alfred M. Bailey and it was this trip that marked the beginning of the lifelong friendship of these two men.

Unfortunately the details of the rabbit extermination campaign were left in the hands of a one time naval officer who was not particularly fitted for the job, and consequently the party found itself not very well prepared. It had been planned to use poison gas, but it was found that each burrow was occupied by birds instead of rabbits. Four male ferrets that had been brought along proved useless because of the same reason. As a result it was necessary to rely entirely on rifles. The party was outfitted with one second-hand twenty-two rifle plus an additional one belonging to Bailey which fortunately had been brought along without authorization. Six thousand rounds of .22 ammunition were

secured and thus armed Willett and Bailey succeeding in dispatching a total of 5020 rabbits and 4 guinea pigs—an average well worth being proud of in spite of Bailey's admission that it was simply a matter of squatting down along side a bush and shooting a dozen or so rabbits seeking shade.

At the outbreak of World War I Willett again responded to the call of the country which had afforded him such a happy and interesting life. His second military career was very short lived, however, for the Armistice was signed a short time after his enlistment and found him at the Infantry Officers Training Camp at Waco, Texas.

In 1919 he returned to southeastern Alaska, intending to settle down in that area with his family. His winters were devoted to trapping while his summers were spent in fishing. During this period he was able to make careful ornithological observations in an area that had not been reported upon previously. In the winter of 1920–21 bird life was scarce and he turned his attention to making his first scientific observations on the mammals of the Wrangell area. These observations resulted in his first mammal publication (Murrelet, 1921, vol. 2, no. 2).

An attempt at fox farming on Grant Island was abandoned because of an unusually warm winter which prevented priming of furs. At this time Willett accepted an assignment from the Alaska Game Commission to make a survey of game conditions in the Aleutian area. During this tour he made a survey of the beaver and muskrat populations on Kodiak Island and a reindeer count on Umnak Island.

In 1927 he left Alaska and took up a post at the Los Angeles County Museum as Assistant Ornithologist and Mammalogist under L. E. Wyman. Upon Wyman's death in 1928 Willett became head of the department of ornithology and mammalogy, a position he held until his death.

As western ornithology had seemingly reached a static state in which most workers were concerned primarily with subspeciation, George turned some of his attention to building up the pitifully small mammal collection possessed by the museum. When he took over the department in 1928, the mammal collection stood at a meager 926 specimens. During the years that followed, Willett built up the collection until it contained over 8000 specimens at the time of his death. He concentrated on securing topotypical material and, as a result, the collection is unique in the number of topotypes it contains of mammals of the southwestern United States. Although his interests and duties at the Los Angeles Museum were concerned primarily with ornithology, he had a keen interest in the growth of the relatively young science of mammalogy and was a member of the American Society of Mammalogists from 1935 until his death.

The advent of World War II found George Willett again eager to serve the country he loved. Age presented a barrier this time, however, and he had to sit by and watch the younger men take over the task. War time restrictions curbed the opportunity for field work, so he contented himself with his lot at home and began to cast about for work to keep him busy during the times he would normally have been in the field. Museum classes in the natural sciences were being formed for high school students at this time and Willett organized a class in ornithology

and mammalogy. The response of the students for classes of this type exceeded all expectations and he found himself swamped with students who were eager to enroll in his classes.

In the mammal classes George taught the students the rudiments of classification, ecology, field collecting techniques, and skin preparation, and in spite of gas rationing, tire rationing, and other wartime obstacles, he managed to get into the desert and collect quantities of kangaroo rats so that his students could learn to prepare mammal skins. George Willett's personality coupled with his vast field experience soon made the bird and mammal classes the most popular of the museum group—and once again we see a glowing example of his ability to understand and endear himself to those with whom he came in contact.

George Willett's contributions and influence in the world of science have terminated far too soon, but his was a full life overflowing in experience and wilderness adventure. In the history of American ornithology, his name stands as one of the great. What he did in American mammalogy, while being significant, is far overshadowed by what he influenced others to do, and his guidance and teachings will be reflected in the mammalogy of the western United States for years to come.

*Los Angeles County Museum, Exposition Park, Los Angeles, California.*

---

## A STUDY OF THE DEER AND ELK HERDS OF ROCKY MOUNTAIN NATIONAL PARK, COLORADO

By Fred Mallery Packard

Among faunistic studies undertaken by the writer for the National Park Service in Rocky Mountain National Park, Colorado, between March 1939 and December 1940, was a survey of the status and condition of the herds of Rocky Mountain mule deer (*Odocoileus h. hemionus*) and elk (*Cervus c. canadensis*). This paper is based upon reports made to the National Park Service at the conclusion of the investigation.

### THE RANGE

In summer, the deer and elk inhabiting the park are to be found scattered throughout the area, especially at the higher elevations where excellent forage is abundant. In winter, however, they concentrate mostly in the lower meadows and ponderosa forests, the principal winter range being located in the long parks east of the divide between 7,800 feet and 8,500 feet near Estes Park village. The deterioration of this winter range has been the subject of many reports since 1930. The more important of these may be summarized as follows:

The first annual spring wild life report in 1929 (Anonymous, 1931) announced the winter range to be in very poor condition because of overuse, and located the critical area as the central district near Estes Park. The browse plants were then in better condition than the grasses, and the deer, more numerous than ever before, wintered better than the elk. Most

of the wintering areas were on private lands. Serious barking of aspens by elk was reported for the first time.

Mr. Dixon's report (1931) verified the inadequacy of the amount of winter range under the jurisdiction of the National Park Service, and recommended the purchase of certain areas by the government. Of these, Beaver Meadow and Horseshoe Park and part of Moraine Park have been bought.

The January 1932 range report (Anonymous, 1932) divides the central range into five areas and classifies the forage plants on each. The southernmost, Mill Creek, was then little used by game, and was in better shape than the others. Moraine Park was even then seriously abused by livestock, and the Deer Mountain area was suffering from overgrazing by game and domestic animals. The Beaver Creek area (Beaver Meadow) was then a moderately grazed hay meadow, invaded by various weeds not necessarily harmful to game. Horseshoe Park, the site of private ranches, was badly overgrazed, fifty percent of the ground cover having been destroyed in places, and weeds were replacing better forage. This damage was due primarily to livestock. The plants adversely affected were *Purshia*, *Prunus* and *Amelanchier*. Indicators of overuse, such as *Artemesia frigida*, *Eriogonum* and *Geranium*, were present.

Thompson (1933) reported that the barking of aspen by elk was as serious as at Yellowstone; that the *Purshia* was producing but half the normal amount of forage; and that sagebrush and *Ribes*, secondary deer foods, were severely overused. He pointed out that although the winter range was well covered by grass and similar plants, abuse had resulted in porcupine grass (*Stipa minor*) becoming the prevalent species, accompanied by dense growths of *Chrysothamnus*, both inferior to the forage species they had replaced.

Subsequently, Wildlife Technician Merlin K. Potts' several reports, and other reports by investigators associated with him, indicated a continuing deterioration of the range, especially in the Mill Creek, Moraine Park, and Deer Mountain areas, the browse plants being affected more than the grasses in spite of beneficial rainfall and snow.

Dixon (1939) submitted a report on the conditions confronting the elk herd. Although it was true that the grasses had been doing well during the previous eight years, compared with the browse plants, he found that the grasses were not in nearly as good condition as they had been in 1931. He believed that the carrying capacity of the range had been exceeded, and that the range was being destroyed through overuse.

Ranger Harold M. Ratcliff, in his report in May 1939 on winter range conditions, reached similar conclusions, and presented a comprehensive discussion of the status of the range plants. This report is the most complete study available of the botanical aspects of the situation and I depended considerably on it in making my own faunistic study of the deer and elk herds.

## THE DEER HERD

*History.*—Little information is available regarding the number of deer that inhabited the present park previous to 1900. Several Indian tribes hunted there, and doubtless found deer an important staple. Deer were moderately plentiful in the Estes Park region when the valley was settled in the 1860's, and the pioneers, too, utilized them for food and clothing. The advent of market hunting almost immediately thereafter affected the deer population nearly as disastrously as it did the elk and those bighorns that inhabited easily accessible places. Deer became scarce, escaping the fate of the elk probably because they are less gregarious, and smaller, hence less productive of marketable meat. At the same time, accelerated occupation of their range by domestic stock, and other factors less easily determined, resulted in a reduction of the deer population to a very low figure. This decline continued apparently into the early 1900's.

What factors caused the initial revival of this small population, and what the relative influence of each was, are speculative.

*Beneficial Factors*. The removal of elk as a competitive species before 1900 was doubtless of benefit to the deer. There are no reports that the range was over-utilized by game in the early days, but the reduction of the number of animals using it permitted the maintenance of the luxuriant growth of browse and grass that then existed over much of the area. This benefit was somewhat offset locally by the introduction of livestock on the range.

The constant destruction of predators, especially of coyotes and cougars, throughout the region probably did not markedly affect the deer until it had been continued for some time, and not until the herd had already been reduced seriously by hunting.

Forest fires usually exact some toll from wildlife, but probable the most influential fire of which there is record was the Bear Lake fire of 1900. It burned hundreds of acres of conifer forest, where certainly a number of deer had been summering, and may have killed some of them. Following a period when the area was unsuited for use by deer, ground cover began to replace the scar, a process that has barely commenced today at the higher elevations, but which is well advanced below 10,000 feet. This new cover is mostly herbs, grasses, shrubs and aspen, much more valuable as food for deer than the conifer forest it replaced. It is probable that the production of browse plants on this and other burns, and in those areas where the forest cover was otherwise removed, has been a factor of some importance in the perpetuation of the deer in this region.

The withdrawal of the park area from hunting in 1915, the addition to it of adjacent sections of the range from time to time since, and the establishment of the Rocky Mountain Game Preserve ensured the survival and increase of the herd thenceforth. At first, the increase was moderate, and it was not until 1930 that indications of over-population appeared.

*Adverse Factors*.—While these and probably other factors were restoring the deer population to a higher level, other influences were even then opposing this increase, and additional ones have been added since. Thus, the reduction of predators possibly benefited the deer when the herd was low, but as the herd increased, their absence may have encouraged the spread of disease through the deer; also, they were not available to reduce the elk properly when that species was restored to the area. A large forest fire, suitably located, may kill some deer, but may result in herd increase by restoring browse plants. It is beginning to appear that various climatic conditions affect differently the relative abundance of parasites in animals, influenced probably by even other complex factors; but the effect on the host species may be quite the reverse of the effect on the parasites.

Most important of the adverse factors was doubtless the continued encroachment of man, his constructions and his domestic stock on the aboriginal deer range. The early decline was partly the result of early settlement, but once the herd had decreased, this factor probably became less effective. When the deer did begin to recover, there was still a large range available, much of which they

used in conjunction with domestic stock. Just at the time (1932) the detrimental effects of multiple use of the range became conspicuous, some large tracts were added to the park and the competition of domestic stock was removed as much as possible.

The establishment of ranches on the winter range was accompanied by the need for increased lines of communication. Roads began to spread over the open pine-brush country that formed the best part of the deer range. Some of them were used only periodically, but as Estes Park became popular, incursions of tourists and commercial people augmented their use. Consequently, several new factors appear: exotic grasses and other plants, such as foxtail, Russian thistle, dandelions, etc., were introduced; the Wyoming ground squirrel (*Citellus r. elegans*) entered the region and spread rapidly over all of the lower meadows; automobiles traveled the roads in increasing numbers, levying toll of wildlife, including deer.

Fences bounding private property have some effect in the reduction of the herd. Adult deer and yearlings appear to have no difficulty jumping wire stretched fifty inches above the ground. If the strands are higher, they usually crawl between them. When alarmed, however, they sometimes leap frantically against the barriers, and may become tangled in the wires. This type of accident occurs most frequently near roads, where the deer are trying to escape automobiles. Near settled areas, dogs often chase deer through fences, resulting in broken legs for the latter. Coyotes, too, probably chase deer in the same way.

Poaching remains a factor difficult to evaluate, but certainly of some effect. Poaching of deer centers around Estes Park village, and usually occurs outside the boundaries of the national park out of season. The constant vigilance of the ranger force has greatly reduced the importance of this illegal activity.

Elk, once removed as a competitive factor, were reintroduced in 1913. They increased even faster than the deer and, although they prefer grasses, their utilization of browse hastened the deterioration of those plants. At present, they are serious competitors of the deer for browse species, while there is reason to believe that the deer are now eating more grasses in spring than they formerly did.

Control measures applied against predators until 1926 reduced the number of game deaths, but at the same time they removed the benefits to the herd as a whole that would have resulted from the natural elimination of the unfit. Predators have been protected in the park since 1926 and are increasing, in spite of their continued destruction near the park boundaries. The moderate restoration of the predatory species, especially coyotes and cougars, before the overpopulation of deer became evident through the deterioration of the range, probably has been beneficial in preventing the spread of infectious diseases through the overcrowded herd.

Too few autopsies of park deer have been made by pathologists trained to detect evidence of inconspicuous diseases to permit definite evaluation of the health of the herd. Opinion agrees that the animals now appear to be in poorer condition in spring than they were at the same season in former years, but other evidence indicates that as yet disease is not seriously prevalent in the herd.

Feces from the range examined by Dr. F. X. Gassner, Colorado State College of Agriculture, were found to be entirely free of parasites. Field autopsies performed by Ranger Ratcliff and the writer revealed no evidence of disease, although there are a few records of a condition diagnosed as necrotic stomatitis in the park files. Isolated cases of hemorrhagic septicemia and other sickness have been reported.

Lungworms have been found in autopsied deer on several occasions, presumably *Protostrongylus macrotis*, which is the form that has been recovered from deer elsewhere in the state. A tapeworm of the genus *Monedezia* was recovered from a doe. Although other parasitic worms and coccidia have been found in park bighorns on the same range, they have not been discovered in any of the deer or elk examined.

Botfly larvae (*Cephalomys* sp.) were frequently found in the pharynx and trachaea of park deer, less often in the nasal cavities. The pharyngeal bots often are expelled by coughing or sneezing. Nasal bots have been known to cause fatal suffocation. Bots, like most parasites, become increasingly active when the host is suffering from malnutrition, an inevitable concomitant of overutilized range; so the potency of these parasites as lethal factors may be considered to be increasing.

Older residents reported that many years ago some deer showed evidence of scabies. Whether the occurrence of this disease in deer can be correlated with its virulent appearance in the bighorns at the turn of the century is not certain.

Several external parasites are known to be present on park deer. Two forms of tick (*Dermacentor andersoni* and *D. albipectus*) have been found heavily infesting deer of all ages and both sexes, but probably have no lethal effect.

As far as could be ascertained, the most lethal factor operating against the continued increase of the park deer at present is the legal hunting near the park boundaries. During the fall of 1939, nine checking stations were located at strategic places in the Roosevelt National Forest. Most of the deer and elk that were killed on that part of the forest and other lands proximal to the central winter range of the park were checked through two stations at Lyons and in Big Thompson Canyon where 296 deer and 23 elk were counted. District Forest Ranger Blackmer estimated that about half of these deer were resident on the forest, while the other half had migrated to it from their summer and early fall range within the park. It may be assumed, then, that 150 bucks of the park herd were shot legally during the 1939 season. It is believed that all of the elk listed above spent part of the year within the park.

*Sex-Age Counts.*—Analysis of the data on legal kills and carcasses found dead in the park, revealed the following proportion of losses during the year: 167 bucks, 28 does, 14 fawns, 15 adults of unknown sex, and 23 deer of unknown sex and age. Therefore, 12 bucks were killed for every two does and for every fawn; or, excluding the 150 bucks shot in season outside of the park, 16 does died in the park for every 10 bucks and 8 fawns. These figures include 207 adults and 14 fawns, a ratio of 15 adults to one fawn. The reliability of this ratio is questioned because young carcasses disintegrate or are destroyed more quickly than those of adults.

The number of deer in the park varies with the season, there being more in summer than in winter. On the basis of counts made annually in spring, just before the migration to the higher fawning grounds, there were about 1400 deer in the park in 1939. Rutter (1937) estimated a 20 per cent annual increase through the production of young, indicating an annual birth of 280 fawns. Other investigators have considered this figure somewhat low, their estimates placing it nearer 28 per cent, which would result in the birth of 390 fawns. The writer favors the higher figure.

The important conclusion to be drawn from these statistics is that in 1939 the known rate of loss (about 18 per cent of the herd) was slightly less than the estimated rate of increase (20 to 28 per cent). Reduced hunting and travel during the war years have undoubtedly affected the survival rate of the deer and elk, but definite data are lacking. Investigators studying game conditions in other parts of Colorado believe that the optimum production of a deer herd with favorable conditions on its ranges is approximately 33⅓ per cent. The state, however, is primarily interested in obtaining the maximum number of game animals that can be supported properly by its ranges, whereas the park is more concerned with the restoration of its winter range.

It is evident, then, that natural and artificial checks had operated by 1940 to slow the former rapid increase of the park deer herd to a point where the rates of production and loss nearly balanced, so that the population was more or less static. They had not succeeded in establishing that balance at a figure low enough to warrant belief that the depleted range would henceforth recover without additional help. In other words, the deer herd still apparently exceeds the carrying capacity of the present forage on the winter range, and the range may be expected to deteriorate further.[1]

## THE ELK HERD

*History.*—During the 19th century, the region now designated as the national park and the adjacent mountain forests supported a large population of elk, either as permanent residents or as migratory bands inhabiting the region several months of the year. No definite information is available on which to base an estimate of the actual number, but the estimate that 20,000 elk occupied Moffatt and Routt counties in 1880 supports the belief that probably as many elk utilized the region then as today, and possibly more.

Hunting by the pioneers for food, sport, and market had drastically reduced the elk population by the end of the century. The few elk left were scattered and unable to rebuild the herds. By 1912 the Routt and Moffatt counties herds had been reduced to 120 animals, and fewer than a dozen were known to remain on the Roosevelt National Forest. There is little question that the species would have disappeared completely within a few years had not steps been taken to restock the region by plants from other areas. Five plantings were made by the

[1] Recent reports from the park indicate that following moderate arbitrary reduction of the deer and elk herds between 1940 and 1945 the range has improved considerably, and that in 1946 it was in better condition than it had been for many years.

U. S. Forest Service in the Roosevelt Forest and the present national park as follows:

| YEAR | NUMBER | AREA |
|---|---|---|
| 1913 | 25 | Estes Park |
| 1913 | 3 | Nederland |
| 1914 | 24 | Estes Park and Lyons |
| 1915 | 25 | Nederland and vicinity |
| 1917 | 47 | Rollinsville |

The 1913 planting at Estes Park apparently was unsuccessful.

These introduced elk multiplied rapidly. Following are the official counts and estimates of the number of elk within the park during the succeeding years:

| YEAR | ELK | YEAR | ELK | YEAR | ELK | YEAR | ELK |
|---|---|---|---|---|---|---|---|
| *1915* | 30 | *1926* | 200 | *1931* | 430 | *1936* | 645 |
| *1917* | 27 | *1927* | 200 | *1932* | 335 | *1937* | 785 |
| *1918* | 60 | *1928* | 200 | *1933* | 335 | *1938* | 865 |
| *1919* | 80 | *1929* | 300 | *1934* | 375 | *1939* | 900 |
| *1920–25* | Increase | *1930* | 330 | *1935* | 550 | | |

The count in 1939 indicated that about 900 elk utilized the park during all or part of that year. The Roosevelt Forest supports an estimated 600, of which about half may be considered as additional to the park population, making a total of 1200 individuals.

*Beneficial Factors.*—The factors benefiting the elk, once they were re-established, were similar to those that enabled the deer to thrive. Primary, probably, was the protection from hunting afforded by the national park and the Rocky Mountain Game Preserve while the numbers of elk were low. Until the growing herd of deer began to destroy the browse, the elk suffered little competition from them. Elk are more secure against the attacks of predators than deer, and few predators were present on the winter range until recently. Adult elk can jump ordinary fences, and are not so likely to be injured as are deer when chased by dogs or coyotes. Although livestock on the ranches in the lower meadows competed with elk for grasses in early years, there was forage enough for all, and the elk were encouraged to visit the hay ricks on the ranches until they increased enough to become a nuisance.

*Adverse Factors.*—Fewer influences affected the elk adversely than were operative against the deer herd. The advent of the automobile had little direct effect on the elk, except to frighten them from their pastures from time to time: elk are seldom hit by cars, although it sometimes happens. There is no evidence that the park elk have ever been seriously diseased. The early wildlife reports comment upon the scrawny appearance of the elk in spring, which some observers were inclined to attribute to disease rising from winter privation. However, the same elk were reported to be in excellent condition in October, and it is probable

that the observers did not realize how ragged a healthy elk can look in spring. The elk doubtless suffer some privation in winter, and grow thin; but the winters in the park are relatively mild and actual starvation is not common.

As the herd increased, competition with livestock became somewhat serious, but in 1932 domestic animals were removed from all of the winter range within park, except in Moraine Park. Deer, at first of minor competitive effect, have increased their consumption of grasses with the loss of much of their natural browse. They eat grass especially heavily in late winter, when both deer and elk are at their lowest vitality.

Some elk, probably old nonbreeding bulls, remain through the winter on open stretches of alpine meadow and are subjected to rigorous climatic conditions their migratory fellows do not have to endure. A severe storm may cause the death of such individuals directly, or by decreasing their defense against predators. There is an odd report of an elk that fell off a cliff and landed in a tree somewhere along the Thompson River, there to die of injuries or starvation. The mating battles of elk sometimes end fatally for one or both of the contestants, but certainly are not a detrimental factor to the increase of the herd.

Disease appears in the elk as isolated cases, not as a condition common to the herd. Occasionally an elk may be seen suffering from leg injuries which reduce its ability to obtain forage, and may thus starve. A young elk observed and later killed by Game Warden Grady Young was suffering from what appeared to be a brain disorder, similar to encephalitis. Internal diseases are not known from park elk, and the only serious external parasites appear to be wood ticks.

The remains of twelve elk were found that had died between July 1, 1939 and July 1, 1940. Twenty-three bull elk were checked through the Lyons and Big Thompson checking stations during the 1939 season, which probably all belonged to the park herd. This produces a total of 34 elk known to have been lost from the park herd during the year.

The increase of the park herd in 1939 was officially computed to be 29 percent, but the rangers believed that figure to be much too low, some expressing the opinion that it should be as high as 50 per cent. It has been shown that the average yearly increase since the elk were restored to the region has been about 45 percent. Whatever the actual birth rate of the elk in the park, it is apparent that it exceeds the mortality rate considerably. In spite of a number of natural and artificial checks, the elk herd is increasing rapidly, and already exceeds the optimum carrying capacity of the winter range.

*Sex-Age Counts.*—Detailed sex-age counts of the bands present on the winter range during the rutting season are not available, but observations indicated that one breeding bull will normally gather a following of between 25 and 40 cows, yearlings and calves. The average size of such bands was one bull to 31 others, of which about 12 would be breeding cows. The "proper" sex-age ratio of elk on a range in good condition does not appear to have been determined. It is not known whether the ratio above is suitable for a range suffering from overpopulation.

Spring counts, made between February 6 and April 24, 1940, when the adult

bulls were no longer with the other elk, produced a ratio of 3 spike (non-breeding) bulls to 12 adult females to 8 non-breeding yearlings to 13 calves on the park ranges. The hunting season outside the park probably destroys as many adult bull elk as is good for maintaining the sex balance of the herd.

SUMMARY

A review of previous reports on the range problem in Rocky Mountail National Park demonstrates a serious deterioration of the forage plants on the lands of the district where deer and elk concentrate in winter. Although browse plants show the greatest damage, there are indications that forage grasses are seriously and adversely affected also. This depletion has progressed, in spite of fairly good climatic conditions, until the range has reached a condition requiring remedy.

The basic cause of range depletion is the overpopulation of deer and elk. A review of the natural and artificial influences operating upon the herds reveals that the annual birth rate and mortality rate of the deer approximately balance, so the herd has reached a more or less static level. This number, however, is above the optimum carrying capacity of the range. The birth rate in the elk herd greatly exceeds the mortality rate, so that elk are continuing to increase rapidly.

LITERATURE CITED

(Unpublished reports in the files of Rocky Mountain National Park)

ANONYMOUS. 1931. First annual spring wild life report, June 15, 1931. 11 pp. photographs.

———. 1932. Report on Condition of Portions of Elk and Deer Winter Range in Rocky Mountain National Park, January 15, 1932. Tables, map.

DIXON, JOSEPH S. 1931. Report on needed winter range for big game in Rocky Mountain National Park, June 30, 1931. 2 pp. photographs.

———. 1939. Special Report on the Elk Problems at Rocky Mountain National Park. December 16, 1939. 41 pp., photographs.

THOMPSON, BEN H. 1933. Memorandum to the director. Re: Elk and deer winter range in Rocky Mountain National Park. September 23, 1933.

RUTTER, JOHN A. 1937. Report on the carrying capacity of the winter range of Rocky Mountain National Park. January 5, 1937.

*34 Randolph St., Passaic, New Jersey.*

# NOTES ON SOME MAINE SHREWS

By Ralph S. Palmer

All specimens mentioned here were collected in Township 5, Range 4, "Lynchtown," Oxford County, Maine, in the summer of 1945. This township extends westward to the New Hampshire border, while its northern boundary is about 10 miles south of the U. S.-Canada line. Included in it are the upper end of Aziscohos and most of Parmachenee lakes, as well as most of the Little and a part of the Big Magalloway rivers. The original forest, mainly of pine and spruce, has long since been removed; the present trees are mostly deciduous ones—even to considerable elevations on the higher mountains.

In the area studied, the population of *Sorex* was above average. *Blarina*, *Peromyscus*, and *Microtus*, however, were at a low stage in their population fluctuations. Trapping was done during the period from June 5 to July 25.

**Sorex palustris albibarbis** (Cope).—On the morning of June 26, in a trap near the outlet of a small spring on a hillside, I found a female water shrew that weighed 14.1 grams. This specimen is shown in Plate 1, figs. A and B. In fig. B, small squares of white paper are laid over the teats on one side, to show their location. On skinning this shrew, I recorded in my field notes that the mammary glands were "fully developed, up over rump, and along sides, the parts before and behind the hind limb *nearly encircling* it by almost meeting *dorsally* above." In a subsequent microscopic examination of a sectioned and stained piece of mammary tissue from the rump above the hind leg, fat globules from the milk were plainly visible.

**Microsorex hoyi thompsoni** (Baird).—A female, weighing 2.5 grams, was removed from a trap June 25. From examination of the swollen uterine horns, I concluded that this animal would soon have been ready to breed. This specimen is shown on the right in Plate 1, fig. E. Beside it, for comparison, is a young male *Sorex cinereus* weighing 3.1 grams, having testes under one millimeter in length. The characteristic differences between these shrews, in sizes of hind feet and tails, are evident in the photograph.

**Sorex fumeus umbrosus** Jackson.—This shrew was much less common than *S. cinereus*, and such is the case throughout Maine. The removal of coniferous forests and their replacement by deciduous trees has probably favored *fumeus* somewhat, for this mammal is more numerous farther south in deciduous woodlands.

Eleven specimens of *fumeus* were collected. The first post-partus female was removed from a trap June 12. This specimen had mammary glands *completely encircling* each hind leg, thus being somewhat more developed than the specimen of *palustris* taken June 26. The weight was 9.8 grams. Hamilton (1940, p. 482) says of *Sorex f. fumeus:* "The first pair of glands are by far the largest, occupying a large area in front of the thighs and extending almost to the sacral vertebrae."

Two subadult males, weighing 4.8 and 5.4 grams, were taken June 6. If they were born in 1945, which is a fair assumption, then breeding probably begins by late April or early May. In New York, female *Sorex f. fumeus* become receptive about mid-April, while the males are fecund by late March (Hamilton, 1940, p. 483). These two males are about as young as any I have ever secured in ordinary snap-back traps in several seasons' trapping. Their size, as compared with a pregnant *S. cinereus* weighing 5.6 grams, is shown in Plate 1, fig. D. In this ventral view, *S. cinereus* is in the middle; its lighter underparts are but one of several distinguishing characteristics.

There is an age characteristic that seems to have been overlooked in *fumeus*. On skinning young individuals, I have noticed a triangular bare area of bone on the top of the skull, with base from 3 to 3.5 millimeters along the lamboidal ridge and apex four to five milli-

meters anteriorly of this on the sagittal crest. My field journal contains such notes as "bare triangular area on cranium"—followed by a drawing showing size of the bare area in young specimens—and "no bare spot on skull" for adults. The largest individual having such a bare spot was a male weighing 6.3 grams, with very small testes, taken July 8. I regret not having photographed specimens showing this characteristic. As these shrews become older and heavier, the head attains a broad and blunt character, with some thickening of the lips, as in *Blarina*, and with the flesh becoming thicker on the sides and extending over the top of the cranium.

**Sorex cinereus cinereus** Kerr.—This is the common *Sorex* of the area studied. On June 5, the first day of trapping, I secured a pregnant *cinereus*. No subadult was caught until June 20. Breeding probably begins in May. I am of the opinion that *cinereus*, like *araneus* in Britain (Brambell, 1935) and *fumeus* in this country (Hamilton, 1940), does not breed the year it is born, but passes the winter as subadult, then breeds and dies the following year. A similar state of affairs may be assumed also for *minutus* in Britain (Brambell and Hall, 1937).

Very large mammary glands are characteristic of nursing *cinereus*. A shrew with glands at greatest development, when found in a trap, usually has the legs spread laterally. This great enlargement must be somewhat of a handicap to locomotion in such an active little mammal. A *cinereus* in this condition is shown in Plate 1, fig. F (with white paper over three teats), while a lateral view of another, freshly skinned, is shown in fig. G. In the latter figure, it can be seen that the enlarged mammaries have completely surrounded the leg; the arrow indicates where the leg was cut off in skinning. A *cinereus* in this post-partus condition often weighs as much or more than individuals containing several fairly large embryos. The two specimens with fullest development of mammaries weighed 6.0 and 6.6 grams. No doubt these glands develop in a short space of time, and recede with equal rapidity as nursing is terminated.

Weights in grams of 29 *cinereus*, whose genital tracts were examined under a binocular dissecting microscope, are as follows: seven adult males averaged 4.69 (4.4–4.8); seven adult females, 5.09 (3.1–6.6); 10 subadult males, 3.40 (2.9–3.9); five subadult females, 3.32 (3.2–3.4). The 14 adults together average 4.89, the 15 subadults 3.70, while all 29 shrews average 4.10 grams. The great range in weights of adult females is accounted for by two being light post-breeders, one heavy in advanced pregnancy, and four nursing and heavy with large mammary glands.

While *cinereus* has marked changes in appearance with age, the way in which the flesh covers the skull does not give such a clear picture as occurs in *S. fumeus*. The three *cinereus* in fig. C of Plate 1 are, from left to right, a female nearly ready to breed weighing 3.6 grams, a subadult male having testes about one millimeter long and weighing 3.4 grams, and a post-breeding female weighing 3.1 grams. The thicker snout and broadened, blunt head of the old female, as compared to the younger ones, is plainly evident.

A nematode, probably *Porocaecum* sp., is often found coiled under the skin or embedded in muscular tissue in this shrew. When present, it is usually on the shoulders or flanks, and sometimes adheres to the skin when the latter is removed from the carcass. Not infrequently a shorter type of roundworm, up to about seven millimeters in length, is found loose in the stomach or embedded in its walls. Nine of these were found in one adult male.

*Remarks.*—The enlargement of the mammary glands, mentioned above for three species of *Sorex* in North America, is also characteristic of *Sorex araneus* of Eurasia, as discussed in detail by Brambell (1935, pp. 43–44, pl. 8). Such enlargement is probably characteristic of the genus. I have not noticed it in any of several hundred specimens of *Blarina* that I have examined.

In measuring shrews before, during, and after rigor mortis, I have been impressed (as others have been) with the variability in the length measurement according to the degree to which the specimen is relaxed. In working with *Blarina brevicauda*, Pearson (1944, p. 51) averaged length measurements "only from shrews which had just been killed by ether or chloroform and were, therefore, in the same stage of relaxation." This standardization of procedure cannot be attained when one is using snap-back traps in the field.

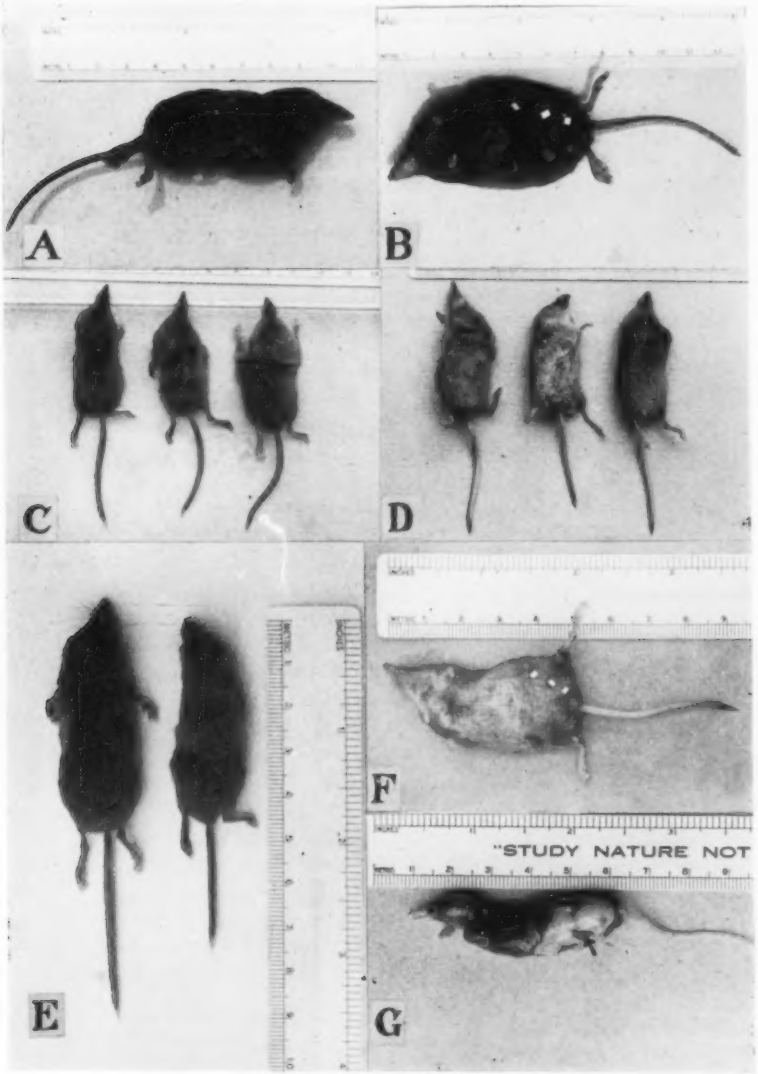


PLATE 1

Maine shrews. A and B: nursing *Sorex palustris*. C: dorsal view of two young (on left) and an old *Sorex cinereus*. D: ventral view of two young *Sorex fumeus* with an adult *Sorex cinereus* between them. E: young *S. cinereus* (left) compared to full-grown *Microsorex*. F: nursing *S. cinereus*. G: mammary gland, surrounding hind leg (cut off at arrow) in nursing *S. cinereus*.

A *Sorex cinereus* will often measure five to seven millimeters longer when relaxed than during rigor mortis. Even though I measure all specimens myself when others are trapping with me, the variation, and consequent inaccuracy when series are averaged, is enough so that little value can be attached to such figures. This is true of most museum specimens. In examining hundreds of such skins, I have noted a surprising range of variation in length measurements. Records of weight, when included on labels, are more useful and reliable biological data. Generally, museum skins of shrews (though not skulls) are useful mainly as locality records for not only must one take the length factor into consideration but one must also discount the size and, in numerous cases, the sex.

Most collectors tend to overstuff the smaller shrews so that one often sees young *S. cinereus* as large as or larger than adult *S. fumeus*. One can train himself to avoid this overstuffing. A simple aid, in the beginning, is to lay the specimen, after it is made up, on a measuring tape to see if the skin has been unduly lengthened in stuffing. Diameter is as easy to control. Although a skin nearest approaching natural size is preferable, still a bad skin is acceptable as long as sex and weight are recorded accurately.

Thanks are due to Miss Edith Krugelis, of Vassar College, for making slides from several pieces of mammary tissue, and to Prof. W. J. Hamilton, Jr., of Cornell University, for several suggestions.

## LITERATURE CITED

Brambell, F. W. Rogers. 1935. Reproduction in the common shrew (*Sorex araneus* Linnaeus). I. The oestrus cycle of the female. Philos. Trans. Roy. Soc. London, ser. B, 225, pp. 1–49, 8 pls., 9 figs.

Brambell, F. W. Rogers, and Kathleen Hall. 1937. Reproduction of the lesser shrew (*Sorex minutus* Linnaeus). Proc. Zool. Soc. London, 1936, pt. 4, pp. 957–969, 3 pls., 5 figs.

Hamilton, W. J., Jr. 1940. The biology of the smoky shrew (*Sorex fumeus fumeus* Miller). Zoologica, vol. 25, pt. 4, pp. 473–492, 4 pls., 1 fig.

Pearson, Oliver P. 1944. Reproduction in the shrew (*Blarina brevicauda* Say). Amer. Jour. Anat., vol. 75, no. 1, pp. 39–93, 6 pls.

*Department of Zoology, Vassar College, Poughkeepsie, New York.*

# NOTES ON THE NATURAL HISTORY OF THE BAT CORYNORHINUS RAFINESQUII IN CALIFORNIA

By Walter W. Dalquest

*Corynorhinus rafinesquii* (Lesson), sometimes termed "lump-nosed bat" or "big-eared bat", ranges over much of North America. Though not common, it is widespread in California. Specimens from the state have accumulated at the Museum of Vertebrate Zoology and at present include 116 study skins in addition to a number of skeletons and individuals in alcohol. Of these the writer has collected and prepared 41 skins. Ten others were obtained by Dr. Seth B. Benson or Miss Mary C. Ramage when the writer was present. Relatively complete field notes are available for these 51 specimens. *Corynorhinus* is a bat of rather striking appearance. Perhaps for this reason, the field notes concerning some of the older specimens are more complete than is usual with most bats. Although a planned life-history study was not made, a considerable amount of new information concerning this species has been gathered.

Specimens listed in the account of geographic variation are all stuffed study skins. A few locality records based on specimens in alcohol are shown on the distribution map. All specific localities mentioned in the text are in California unless otherwise stated.

The genus *Corynorhinus* is very closely related to the European and Asiatic genus *Plecotus* and to the rare Mexican bat, *Idionycteris*. Three species of *Corynorhinus* are currently recognized. *Corynorhinus phyllotis* is a rare species, known only from Mexico. *Corynorhinus macrotis* occurs in the southeastern United States. *Corynorhinus rafinesquii*, with five subspecies, ranges from southern Mexico to British Columbia and from the eastern to the western coasts of the United States.

*Corynorhinus rafinesquii* measures about 4 inches in total length; the tail slightly less than 2 inches. The distance between the tips of outspread wings is 10 to 12 inches. The body is small and covered with long, soft, lax fur. The color of the fur varies from dull whitish to dull blackish-brown. The most striking feature of the animal is the ears. These are slim, pointed, and almost 1½ inches long. Paired glandular masses rise on the sides of the muzzle, curve inward, and resemble thumbless boxing gloves with their median surfaces not quite in contact. Membranes of wing and tail are extremely thin. The fine print of a newspaper can easily be read through the outstretched wing of a living bat.

## VARIATION AND DISTRIBUTION IN CALIFORNIA

Individual variation is moderate in *Corynorhinus* from California. Within the range of any subspecies, some individuals may be darker or lighter, more reddish or more grayish, than the average. Color of membranes seems quite constant. Variation in size is reflected in the standard measurements taken, which in a series of 25 adult females from Mission San Jose, Alameda County, is shown in Table 1.

TABLE 1.—*Variation in external measurements of Corynorhinus*

| | MEAN | STANDARD DEVIATION | MEAN DEVIATION FROM MEAN | RANGE |
|---|---|---|---|---|
| Total length | 101* | 3.4 | 2.8 | 95–108 |
| Length of tail | 46 | 2.1 | 1.6 | 43– 51 |
| Length of foot | 10 | 0.3 | 0.1 | 9– 11 |
| Height of ear | 35 | 0.6 | 0.4 | 34– 37 |
| Height of tragus | 14 | 0.6 | 0.5 | 14– 16 |

* Measurements in millimeters.

FIG. 1. Distribution of *Corynorhinus rafinesquii* in California. The range of *C. r. townsendii* is shown by cross-hatching, *C. r. intermedius* by vertical lines, *C. r. pallescens* by stippling. Dots represent localities whence specimens have been examined.

Weights of these specimens are not available. Five females, in an early stage of pregnancy, from 4 miles south of Calistoga, Napa County, were weighed soon after death. Variation was: mean 7.7 grams, mean deviation from mean 0.2, range 7.4–8.0.

The sexes seem not to differ in color. Because the two sexes are rarely found together, we have no series of males and females from a single locality large enough to compare as to size. Two males from Mission San Jose and six from various localities between the San Joaquin Valley and the Pacific Ocean compare with the 25 females from Mission San Jose as follows:

| | MALES | FEMALES |
|---|---|---|
| total length | 97 mm | 101 mm |
| length of tail | 43 | 46 |
| length of foot | 10 | 10 |
| height of ear | 35 | 35 |
| height of tragus | 14 | 14 |

Males average smaller in length of body and tail than females. In a series of living bats, the females may be separated from males on the basis of larger size.

Almost nothing is known of age variation in *Corynorhinus rafinesquii*. The life-span is not known. Several bats were banded and released but were never recaptured. Growth must be rapid, for there is, in the collection of the Museum of Vertebrate Zoology, only a single specimen that can be identified as a nearly grown "young of the year." Presumably it was not over three months of age when captured. In color and size it resembles adults from the same locality. Only in the skull and the joints of the fingers can a trace of juvenile characters be seen. Some other specimens, notably males taken with females in the late summer, are suspected of having been born in the spring of the same year. They cannot, however, be separated from adults on the basis of size, color, or skull.

Geographic variation is quite strong in *Corynorhinus rafinesquii*, and three races occur in California.

**Corynorhinus rafinesquii pallescens** Miller

*Type locality.*—Keam Canyon, Navajo County, Arizona.

*Diagnosis.*—Color of upper parts whitish, buffy, or pinkish buff; underparts white to pale buff; membranes pale.

*Range in California.*—The southern part of the state and the desert areas south and east of the Sierra Nevada.

*Specimens examined.*—Total number 35, from: *San Diego Co.:* Escondido, 2; Julian, 1; Vallecito, 2; 1½ mi. NW Vallecito, 2. *Riverside Co.:* near Kenworthy, San Jacinto Mts., 12; Riverside Mt., Colorado River, 2; near Whitewater, 1. *San Bernardino Co.:* Horse Spring, 2700 ft., Kingston Range, 1; 5 mi. SW Ivanpah, 4500 ft., 2; Mitchell's Caverns, 4500 ft., Providence Mts., 1. *Inyo Co.:* 4½ mi. SW Bishop, 5200 ft., 2; Mountain Springs Canyon, 5500 ft., Argus Mts., 2; 4 mi. SSE Bishop, 4700 ft., 4. *Kern Co.:* Red Rock Canyon, 1.

*Remarks.*—Specimens from the Colorado Desert resemble those from Navajo County, Arizona. The material from coastal southern California averages slightly darker but is closer to *pallescens* than to *Corynorhinus r. intermedius*. The single specimen from Red Rock Canyon, Kern County, is referred to *pallescens* on geographic grounds although in color it resembles *intermedius*.

**Corynorhinus rafinesquii intermedius** H. W. Grinnell

*Type locality.*—Auburn, Placer County, California.

*Diagnosis.*—Color of upper parts dull reddish brown or grayish brown; underparts buffy; membranes dark.

*Range in California.*—The Channel Islands and the central and northern parts of the state, exclusive of the north-coastal area.

*Specimens examined.*—Total number 58, from: *Los Angeles Co.:* Johnson's Harbor, Santa Catalina Island, 1. *Kern Co.:* Lebec, 1; Weldon, 1. *San Luis Obispo Co.:* 6½ mi. SE Shandon, 1; 5 mi. SW Adelaida, 2200 ft., 1; San Simeon, 1. *Monterey Co.:* Stonewall Creek, 1300 ft.; 6¼ mi. NE Soledad, 1. *San Benito Co.:* 4 mi. WNW Panoche, 1. *Santa Cruz Co.:* 3 mi. E Santa Cruz, 1; Mouth of Meder Creek, 2; 2 mi. SW Brookdale, 1. *Santa Clara Co.:* 2¼ mi. NW San Felipe, 1; Evergreen, 3. *San Mateo Co.:* 2 mi. E Pescadero, 1. *Alameda Co.:* Mission San Jose, 27; 4 mi. ESE Mission San Jose, 1. *Tehama Co.:* Mouth of Battle Creek, 350 ft., 1. *Placer Co.:* Auburn, 8; Pioneer Cave, 3. *Lassen Co.:* near Wendel, 1.

*Remarks.*—This slightly differentiated race maintains constant characters over much of California. It is intermediate between the pale desert race and the dark, north-coastal form in geographic range and color. It has probably developed intermediate characters in response to the nature of the environment it inhabits which is intermediate between the humid, forested coast and the arid, treeless deserts. Genetic intergradation is not necessarily implied.

Intergradation between *intermedius* and *pallescens* is not sharp. In the Tehachapi Mountains, between the arid San Joaquin Valley and the Mojave Desert, one would expect *Corynorhinus* to be pale. A specimen from Lebec, Kern County, is as pale as many *pallescens*, but a specimen from Weldon, Kern County, only about 20 miles from the Mojave Desert, is dark, like *intermedius*. A specimen from Red Rock Canyon, mentioned in the account of *pallescens*, is also dark. It would seem that the characters of *intermedius* overflow, as it were, onto the border of the desert where *pallescens* might be expected to occur.

In some species of bats, notably *Myotis yumanensis* and *Myotis californicus*, the dark color typical of the north coastal subspecies occurs also in the immediate coastal strip south of San Francisco Bay. Little or no darkening is noticeable in *Corynorhinus* from this area. *Corynorhinus* seems not to occur in the Great Valley.

**Corynorhinus rafinesquii townsendii** (Cooper)

*Type locality.*—Vancouver, Clark County, Washington.

*Diagnosis.*—Color of upper parts dull gray, washed with dark brown; underparts buffy; membranes dark.

*Range in California.*—The humid coastal belt and the coast ranges from San Francisco Bay north to Oregon.

*Specimens examined.*—Total number 23, from: *Napa Co.:* ¼ mi. S Angwin, 1600 ft., 4; Angwin Creek, 1500 ft., 1 mi. S. Angwin, 1; Pope Creek, about 8 mi. NW Monticello, 1; 4 mi. S Calistoga, 9. *Lake Co.:* Long Valley, 1; 4 mi. E Upper Lake, 3. *Sonoma Co.:* 10 mi. E Stewart's Point, 1. *Mendocino Co.:* 1½ mi. N Gualala, 1. *Humboldt Co.:* Carlotta, 2.

*Remarks.*—G. M. Allen (1916) considered a skin from Mt. Veder, Napa County, to be "indistinguishable from typical *townsendii*". H. W. Grinnell (1918) referred the same specimen to *intermedius*, stating that it "varies strongly in the direction of *townsendii*". The series now available from Napa County shows intergradation, but even the palest individuals fall within the range of variation for *townsendii*. Most of the specimens are dark. The four specimens from Lake County are also intermediate but are referable to *townsendii*.

A specimen, not seen by me, from Happy Camp, Siskiyou County, was also referred to *townsendii* by Allen (1916) and to *intermedius* by Grinnell (1918). It comes from an area where intergradation between the two races is to be expected.

There seems to be no difference in size between *intermedius* and specimens from Cali-

fornia referred to *townsendii*. It has been alleged (Grinnell, 1918, p. 345) that *intermedius* is larger than *pallescens*. The statement is based on the comparison of a series of eight male and two female *pallescens* with a series of *intermedius* that included one male, nine females, and a specimen of unknown sex. It is possible that secondary sexual variation rather than geographic variation is responsible for the difference in size. No large series of female *pallescens* is available to compare with the females of *intermedius* from Auburn and Mission San Jose or the females of *townsendii* from Napa County. Less reliable methods of comparison indicate that *pallescens* is little, if any, smaller than *intermedius* or *townsendii*.

Geographic variation in the species in California may be summarized as follows: a pale race in the southern part of the state and the deserts to the east; a dull, grayish or reddish race in the central and northeastern section; a dark race in the northwestern coastal area. The boundaries between the ranges of the three races are not sharp. The dark *townsendii* extends inland from the humid coastal area to the coast ranges, where *intermedius* would be expected to occur. In turn, *intermedius* extends onto the very edges of the desert, where *pallescens* might be expected to occur. Saturate "islands" that occur in the ranges of some species of bats, such as the coastal area south of San Francisco Bay, are not found in the range of *Corynorhinus*. The races intergrade over broad areas and there seems to be relative weakness of habitat restriction. Presumably there is considerable genetic mixing in the areas of intergradation, and selective factors for color must be relatively weak.

## DAYTIME RETREATS

*Corynorhinus rafinesquii* is a cave-haunting species that, like many other species of bats, has found the structures of man a suitable substitute for its more natural retreats. These bats now inhabit mine tunnels and attics of buildings as well as caves.

Grinnell and Swarth (1913) found 17 specimens of *pallescens* in a mine tunnel at Kenworthy, Riverside County, on May 22 and June 5, 1908. Individuals were found from near the entrance of the tunnel to its end, 600 feet away. They were scattered, hanging singly on the walls. All were dormant. Of the 17 bats, 15 were males.

F. Stephens (MS 1908) found a male *pallescens* and a male *Myotis californicus* in the dark rooms of a vacant house at Julian, San Diego County, on July 24, 1908. The mummified body of a male *Antrozous pallidus* was found on the floor of the house.

At Mission San Jose, Alameda County, a colony of *Corynorhinus r. intermedius* was found in the attic of the old mission. The mission building is an adobe structure, erected by the Spanish priests in 1797. The valley in which the mission is located contains a cool stream bordered by broad-leafed trees and dense thickets of brush. The hills nearby have extensive grassy slopes, groves of oaks, and areas of chaparral. There are rock cliffs a few hundred yards from the mission building.

The mission was visited on September 27, 1942. Bats were found in the dimly lighted attic, but were active and too shy to be captured by hand. On October 4, 1942, Dr. Charles Reed and the writer returned to the mission armed with long-handled butterfly nets. The bats again were active and shy. They flew about the attic in open circles or broad "figure 8's", occasionally hanging from the rough boards of the ceiling. Because they were extremely skillful at dodging the nets, only nine specimens, eight females and a male, were taken after

several hours of intensive work. On January 2,1943, a single dormant male was found clinging to a wall in the attic. On May 7, 1943, about 75 females, most of them accompanied by newly-born young, were present. A few bats were flying about when we entered the attic. Approximately 50 adult bats were in an oval cluster, clinging to the ceiling near the ridgepole. They were so tightly gathered together that the edges of the oval cluster appeared to be a solid line. Eight more bats were in a smaller cluster a few feet away, and separated from the large mass by a rafter. Beyond the next rafter was a clump of four bats. Still another group of bats was found in a darkened part of the attic about 30 feet from the large cluster. These were in flight when observed. About half of the larger cluster was captured, and bats were captured from the other groups also. All were females. The mission caretaker said that he had first noted bat droppings that year (1943) about a week earlier. No other species of bat was found at the mission, but the caretaker showed us a crevice in a doorjamb where small, black bats had once lived. They had not been seen for many years. The crevice was nearly filled with droppings of a small species of bat, probably *Tadarida* or *Myotis*.

An old winery, one-half mile south of Angwin, Napa County, was visited by Mary C. Ramage and the writer on March 18, 1945. The winery consists of two old buildings, long abandoned. One is of wood and the other with the first floor of stone, the upper story of wood, and a roof of metal. The buildings measure about 30 to 60 feet and each has two stories. The lower, or basement, section of each was cool and humid. The earth floors were damp. A *Corynorhinus* was found hanging from the ceiling of an alcove in the thick stone wall of one building. The alcove measured about three feet deep, seven feet high, and six feet wide. A partly open door was the only means of entrance for the bat. A *Myotis thysanodes* was clinging to a rafter 30 feet away. Another *Corynorhinus* was found in the darkest part of the attic of the wooden building. It was clinging to the shady side of a rafter, 20 feet from the ground. All three bats were females and all were dormant. No bats were found in the warmer, drier attics of these buildings. There were great piles of droppings in the attics, however, some of which were unquestionably of *Antrozous*. There are numerous grassy fields near the old winery. Some of the nearby hills are densely clothed with chaparral but most have a dense forest of coniferous trees and madroña.

On April 1, 1945, Miss Ramage and the writer visited an old, long-abandoned winery about four miles south of Calistoga, Napa County. This winery is a wooden building about 35 by 60 feet and has two stories. It is situated at the edge of a cultivated valley but is itself in the fringe of the dense tangle of oaks, coniferous trees and chaparral that covers the hills to the east. No bats were found in the lower story of the winery, but a cluster of *Corynorhinus* was found clinging to the shingles near the ridgepole of the warm, dry, dimly-lighted attic. The roof had a slope of about 30°. The bats were about ten feet from the floor. About 20 bats were present, of which nine, all females, were captured. No other bats were found in the winery but an *Antrozous* was secured in a nearby building.

Miss Ramage, Mrs. Peggy Dalquest and the writer searched for bats in an abandoned mercury mine one mile west-north-west of Panoche, San Benito

County, on April 21, 1945. The area about the mine is barren, the hills being clothed with thin grass and a few oaks and shrubs. The mine consists of many hundreds of feet of tunnels at several levels. The tunnels were cool, although the temperature outside was near 100° F. Miss Ramage made the only find; a dormant male *Corynorhinus* hanging free from the rough rock ceiling. It was about 35 feet from the nearest entrance.

On June 13, 1945, Seth B. Benson and the writer searched for bats in an old, long-abandoned house along the shore of Soap Lake, about two miles northwest of San Felipe, Santa Clara County. A male *Corynorhinus* was found clinging to a rafter near the peak of the roof in the warm, dry, dark attic. Other bats found in various crevices in the main floor of the house included a male *Myotis yumanensis*, a male *Myotis californicus*, and a male *Tadarida mexicana*. The area about the house included rolling, grassy hills, open oak groves, a small lake, and a marsh.

Benson and the writer frightened a *Corynorhinus* and two *Myotis volans* from the attic of an abandoned house situated eight miles west-south-west of Coalinga, Fresno County, on June 16, 1945. The *Corynorhinus* evaded us and escaped. This locality is in oak-covered hills just below the juniper and piñon belt of the hills to the west.

On June 24, 1945, several mine tunnels in the hills between Paso Robles and Cambria, San Luis Obispo County, were examined. Bats were found in one located 5 miles southwest of Adelaida. This was a horizontal shaft, low on a grassy hill. Surrounding slopes were densely clothed with oaks and chaparral. A fall of earth formed a dam at the entrance. Behind the dam, water was knee-deep. An active male *Corynorhinus* and a dormant female *Myotis evotis* with a new-born young were discovered near the end of the 75-foot long tunnel.

The same day we searched for bats in a warehouse at San Simeon, San Luis Obispo County. *Myotis yumanensis*, *Antrozous pallidus*, and *Tadarida mexicana* were found in crevices between the walls and the roof at one end of the warehouse. At the opposite end was a small, warm, dry, dark attic, about 15 by 20 feet. The attic was inhabited by a single male *Corynorhinus*, which was awake and active. The land about the warehouse supports dense, oceanside vegetation—brush and lush annuals. To the east the hills rise with extensive grassy slopes, oak woodlands, and chaparral.

On June 28, 1945, two non-pregnant female *Corynorhinus* were found in the attic of a barn at the mouth of Meder Creek, Santa Cruz County. They were clinging, side by side, near the peak of the roof. The attic was about 30 by 35 feet, had a concrete floor, and was cool and dark. The bats were active. On each side of this locality are low hills with grass, oaks and chaparral. A short distance upstream was a redwood forest.

On June 30, 1945, an abandoned house two miles east of Pescadero, San Mateo County, was searched for bats. The house is near a cool stream with dense bordering thickets. The nearby hills are covered with oaks. A short distance to the east, the oaks give way to typical redwood forest. No bats were found in the main story of the house. The attic was separated into three sections. All

three parts were warm, dry, and dusty. In two sections, cobwebs draped the rafters and no fresh bat droppings were on the floor. A male *corynorhinus* was found hanging from a rafter in the third section. It was awake and active. Few cobwebs were seen in this section, and there was much fresh bat droppings on the floor. Seemingly the bat lived in one part of the attic only.

The old winery, one-half mile south of Angwin, Napa County, mentioned earlier, was revisited by Miss Ramage, Benson, and me, on July 8, 1945. A single male *Corynorhinus* was found in the basement of the wooden building. It was active when found. A colony of about 60 male *Antrozous pallidus* and another colony, consisting of about 50 adult and young *Myotis thysanodes*, were found in the roof. Another male *Corynorhinus* was found in the warm, dark, dry attic of the wooden building. It also was active.

All retreats of *Corynorhinus* examined personally were dark or but dimly lighted. The retreats occupied by the colony of females at Mission San Jose, Alameda County, and the colony of females near Calistoga, Napa County, were the best lighted. In these retreats the light was dim, but once one's eyes were accustomed to the dimness, the bats could be seen without a flashlight. Lights were necessary in the other retreats. No bats were found in crevices; instead they were found hanging from the most open parts of the ceilings. No preference was noted as to temperature or humidity. *Corynorhinus* were taken from dry, dusty attics where the temperatures were so high as to cause the collector discomfort. Others were taken in flooded mine tunnels where the rock walls were cool and damp. All retreats were places seldom disturbed by humans.

### FLIGHT

No one seems to have observed a *Corynorhinus* engaged in its hunting flight. The species is a late flier and probably does not leave its daytime retreat until it is far too dark for observation.

*Corynorhinus* sees well, is a swift flier, an agile dodger, and possesses an excellent sense for danger. On one occasion, four persons armed with butterfly nets, spent several hours attempting to catch bats in flight at Mission San Jose, Alameda County. A number of bats were touched on the wing but only one was caught in free flight. The nets were useful only to clap over bats that lit momentarily on the ceiling. Hundreds, if not thousands, of sweeps were made with the nets, only to have the target drift tantalizingly to one side. On another occasion the writer spent nearly a half-hour in pursuit of a *Corynorhinus* trapped in a low-ceilinged room about 20 feet square. On still another occasion a *Corynorhinus*, supposedly trapped in a narrow mine tunnel, slipped past two persons and escaped.

As a result of these and other experiences, we have adopted the following rules in collecting this bat: if a *Corynorhinus* is hanging with its ears coiled, it is dormant and can be easily captured by hand. If its ears are outstretched, however, it is active and alert and should be shot without delay. A .22 caliber pistol loaded with shot works well in such circumstances.

Several *Corynorhinus* captured in Napa County were released in a room 20 feet

square and 10 feet high. Their actions cannot be considered normal but may approximate their usual habits. The bats were first placed on a flat surface. They stretched their wings and, with a single violent motion, were in flight. They made no attempt to walk or scramble about on the floor.

The characteristic flight, in the room described, was a series of narrow "figure 8's", varied with occasional ovals or circles. If not molested, the bats flew with a swift, easy flight. Wing-beats were deep and smooth. A few wing-beats were usually followed by a pause with set wings. In this interval the bat would glide several inches and lose altitude perceptibly. The lost altitude was smoothly recovered in the next series of wing-beats. Individuals would occasionally interrupt this easy flight with a series of steady wing-beats that carried them at a much greater rate of speed. In this more speedy flight, the body remained almost level.

The enormous ears are scarcely noticeable when the bat is in flight. They are pointed anteriorly, just a little up from the horizontal plane of the body, and are held almost parallel. The head is bent ventrally. From the base of the neck to the tip of the tail, the body forms a smooth curve. The legs are widely spread, causing the free border of the tail membrane to form a horizontal line, from calcar to tail tip. The curved tail thus holds the uropatagium up in a shallow pocket or pouch. The flight is silent; no squeaking, swishing, or fluttering occurs. *Tadarida*, *Antrozous*, and several species of *Myotis* were released in this same room, and all of these, at times, made noises in flight.

The alighting of *Corynorhinus* is in action of grace and beauty. The bat approaches a chosen perch from beneath and sweeps up with set wings, at an angle of 45°. Gravity helps break the speed of flight. When almost to the perch, the swoop becomes vertical and the bat seems to "bob" in the air. Several things happen almost simultaneously. The wings close and the body completely reverses itself in the air. Holding its vertical position in the air, the entire body pivots sideways with seeming slowness until the head is down. At that precise moment the feet touch the perch and the claws grasp tiny crevices. The action is soundless. The claws grip truly at the first attempt. Once the claws take hold, the wrists are brought in under the chin. The claws of the thumbs catch in crevices. The thumbs usually lie at a 45° angle upward and outward from the forearm. The wings are brought in close to the forearm, and the wing-tips are pulled in close to the flanks and lie against the side of the body, sticking up like tiny sails. The tail is relaxed and curves under and down, in a semicircle. The head is drawn back and the neck bent outward. Some arching of the back occurs as the chest is pushed out from the wall and supported by the wrists. As the bat peers about, moving its head, the ears swing from side to side and from a horizontal to a vertical position. If undisturbed, the bat usually relaxes after a few minutes. The head is bent inward until the muzzle touches the chest and the long ears droop downward. The claws of the thumbs release their grip on the wall and the forearms swing out parallel with the body.

*Corynorhinus* in flight showed considerable interest in a screen cage containing other bats of the same species and several *Myotis thysanodes*. They hovered

beside the vertical side of the cage. Several alighted on the vertical screen and one hung from the underside of a chair a few feet away. They seemed reassured by the nearby presence of their same kind and assumed their relaxed posture much more quickly than when they alighted on the unfamiliar sidewall. Similar interest in the caged bats was shown by released *Myotis thysanodes*. These bats hovered over the top, not the side, of the cage, and several alighted on it. They squeaked and moved about, seemingly much agitated by the presence of the bats in the cage.

*Myotis thysanodes* that alighted on the wall usually moved over to the nearest *Corynorhinus*. This seemed to annoy the *Corynorhinus*, for they usually took flight as soon as touched. One, however, allowed the small bat to climb over it before flying. This action of *Myotis thysanodes* is thought to be an expression of their sociable habits. On one occasion, however, a *Myotis* soared up at a *Corynorhinus* with a shrill squeak. The *Corynorhinus* took flight, apparently in alarm, and the *Myotis* lit in the place vacated. There was ample room elsewhere for the *Myotis*, and several *Myotis* were already hanging from the wall nearby. This action seemed due to aggressiveness or bad temper. *Corynorhinus*, once at rest, did not move about. The nervous, noisy *Myotis* scrambled about a great deal.

### RESTING AT NIGHT

Bats feed rapidly and fill their stomachs in a short time. Some *Myotis* seem to secure a full meal in about 15 minutes. *Corynorhinus*, in common with several other species of bats, retires to a convenient cave or building to hang up and rest. This habit was noted by Stephens (1906) and quoted by Grinnell (1918). Few collectors have taken advantage of this habit in capturing bats.

Stephens obtained *Corynorhinus*, *Antrozous pallidus*, and *Myotis californicus* at Vallecito, San Diego County, on May 25 and 27, 1909 (MS of 1909). Vallecito was once a station on the old Butterfield Stage Route. At the station there is a "wet place of tulles and grass of an acre or more surrounded on the south, east and west sides by a thicket or grove of mesquite and screw bean trees, outside of which is a dense growth of arrow-weed, reaching to the foot of the hills to the southward. These hills are about ¼ mile (away) . . . are rough . . . of granite. The nearest pine-covered ridges being 6 or 7 miles away." The station, at the time of Stephen's visit, was an adobe house. No bats were in the building by day. The collector filled the windows with brush and fastened a rolled-up blanket above the door. After dark the blanket was let down and any bats trapped were caught in a butterfly net.

The writer has used this method of trapping bats with considerable success. Houses, cabins, and mine tunnels have been used as traps. Various methods have been used to close the exits when bats are in the trap.

At Lebec, Kern County, two small buildings served as bat traps on June 4, 1945. At midnight the traps held a *Corynorhinus*, 6 *Myotis yumanensis*, and 2 *Myotis volans*. Earlier in the night these same traps caught 11 *Myotis yumanensis*, 3 *Myotis volans*, 1 *Myotis californicus*, and 4 *Antrozous pallidus*. Three *Myotis thysanodes* were taken in the traps later.

At Red Rock Canyon, Kern County, an old mine tunnel served as a bat trap on June 21, 1945. This tunnel was visited at intervals in the night. Three *Myotis californicus* were cornered in the narrow tunnel and knocked down with a handful of brush. A *Corynorhinus* was cornered in the tunnel about 11:30 p.m. It evaded our attempts to knock it down for several minutes, then managed to slip past both of us and escaped. About ten minutes later another *Corynorhinus* flew into the tunnel and hung from the rough rock ceiling. It was shot by Benson and found to be a male.

### BREEDING AND YOUNG

Separation of the sexes is quite complete. Females gather in colonies in the spring, but the males remain scattered. The writer took one male and six females from the attic of the old Mission San Jose, Alameda County, on October 4, 1942. It is suspected that the male was a young bat, born that spring, that had not yet left the colony. A male taken with four females at Auburn, Placer County, on August 4, 1909, was a young of the year. The same may be true of a male taken with two females from a colony at Evergreen, Santa Clara County.

Males and females may occur in the same mine tunnel, at least in winter and early spring. F. Hooper (MS 1939) found a male and two females in a mine tunnel 4½ miles southwest of Bishop, Inyo County, on December 26, 1939. The bats were scattered singly along the tunnel. Grinnell and Swarth (1913) took 15 males and 2 females from a 600 foot mine tunnel near Kenworthy, Riverside County, on May 22 and June 5, 1908. The bats were found singly from near the entrance to near the end of the shaft. Lack of other suitable retreats may have accounted for the presence of so many males together here. There are two males from Escondido, San Diego County, and two males from five miles southwest of Ivanpah, San Bernardino County, obtained May 18, 1938. These may have been together in single retreats or they may have occupied separate retreats.

There are 23 records of males occurring singly in retreats in contrast to the few records of males occurring together. There are, in addition, four records of single males from bat traps. There are four females, each from a single locality, in the Museum of Vertebrate Zoology. There are no field notes to accompany two of these specimens. More than one bat might have been present in these instances. One female was taken alone in a bat trap. There are 14 records of more than one female occurring together in a retreat.

*Corynorhinus* probably copulates in the late summer or fall, and the sperm lie dormant until the following spring. Two females taken one-half mile south of Angwin, Napa County, on March 18, 1945, had no embryos. The swollen uterus of one was carefully examined, and the uterine horns were seen to be firm and sausage-shaped. Female *Myotis yumanensis* taken in the early spring had uteri of similar appearance, and contained sperm. It is believed that the uteri of the *Corynorhinus* also contained sperm, but this was not determined microscopically.

The following data are from specimen labels and field notes and are arranged chronologically by day and month but not by year. Unless the specimen label

stated that no embryos were present, it is assumed that the sex tract was not examined.

March 18, 1900. *Riverside Mountain, Riverside County*, a female contained an embryo.
March 18, 1945. *½ mi. S Angwin, Napa County.* Two females without embryos but probably with sperm in their uteri.
April 1, 1945. *4 mi. S Calistoga, Napa County.* Nine females: one not pregnant; four with tiny embryos; one with 3 mm embryo; two with 4 mm embryos; one with 6 mm embryo.
May 7, 1943. *Mission San Jose, Alameda County.* 17 newly-born young taken with 25 adult females.
May 27, 1909. *Vallecito, San Diego County.* A female with a large embryo.
May 29, 1940. *4 mi. SSE Bishop, Inyo County.* A female with a 12 mm embryo.
June 5, 1908. *Kenworthy, Riverside County.* A female with a large embryo.
June 28, 1945. *Mouth of Meder Creek, Santa Cruz County.* Two females were not pregnant and gave no evidence of having nursed young.
August 4, 1909. *Auburn, Placer County.* A nearly grown young of the year.

The breeding season seems to be quite irregular. The earliest known date of pregnancy is March 18; the latest, June 5. The earliest known date of birth is May 7.

As pointed out above, the time of copulation is not definitely known. The testes of a male taken January 2, 1943, were tiny. Six males taken between June 4 and July 8, 1945, had testes from 6 mm to 8 mm in length.

The 17 young taken at Mission San Jose on May 7, 1943, varied from newly-born to perhaps two or three days of age. One was still attached to the mother by an umbilical cord 36 mm in length. The placenta was extruded 2 mm. A broken umbilical cord, attached to a baby bat, was 24 mm long.

New-born *Corynorhinus* are entirely naked. The body is pinkish-gray in color; the dark gray nose lumps conspicuous; the ears dark gray; the tail membrane pale gray basally, blackish at the border; the ears long and pointed (height from crown 12.5 mm). The wings are tiny (shoulder to elbow 11.4 mm, elbow to wrist 17 mm, longest finger 19.6). The thumbs are relatively large (6.5 mm). The legs are long and stout (tibia 12.3 mm, foot 9 mm). The tail is relatively short (15 mm, 33% of total length).

In the next obvious stage of development the back acquires short, soft, brown fur. The belly is still naked. The ears are wider, less pointed. The muzzle possesses numerous short bristles. The head is furred in the occipital region and in a narrow strip between the ears. Measurements are: total length 52, length of tail 19, foot 9.5, ear (from notch) 17.3, tragus 6.5, tibia 13, forearm 23, thumb 6.5, longest finger 26.

Growth must be very rapid. The young must ordinarily be born in May or later. Juvenile characters have almost completely disappeared by early August.

### HIBERNATION AND DORMANCY

Whitlow (Whitlow and Hall, 1933) studied the hibernation of *Corynorhinus* near Pocatello, Idaho. He found that the bats entered mine tunnels where the temperatures were above freezing, and "on the uneven ceilings of these tunnels,

the dormant *Corynorhinus* cling singly, head downward, to the inclined faces of the rocks".

*Corynorhinus* becomes dormant at other seasons than winter. Winter dormancy is usually termed hibernation, but little actual difference is involved. Hibernation is not complete, for Whitlow found that the bats moved about in their winter retreats. Dormant individuals, at any time of the year, awaken if handled. Winter dormancy is of longer duration and the posture of the bats, perhaps because of this, seems different from that in the shorter periods of dormancy. In the winter the bats are found pressed tightly against a wooden or rock surface, clinging by both feet and thumbs. In the ordinary dormant condition the bats hang free from a horizontal surface, clinging by feet alone.

In dormant *Corynorhinus* the long ears are coiled backward and downward in a close spiral and tightly folded laterally. The tail is bent under and the wings are brought in against the body. The body has a slight ventral arch. This is well shown in the series of plates in Grinnell (1918).

F. Hooper (MS 1939) entered several mine tunnels near Bishop, Inyo County, on December 6, 1939. Bats were found only in the Chipmunk Mine, 5200 feet elevation, 4½ miles southwest of Bishop. The temperature at the tunnel entrance was 48° F. A *Corynorhinus* was found 20 feet from the entrance; temperature 55° F. Seventy feet farther was a second *Corynorhinus*. Temperature there, and farther in the tunnel, was 58° F. Ten feet away was a *Myotis californicus* and 15 feet farther was a third *Corynorhinus*. These bats were clinging tightly, flat against the tunnel roof. Their ears were closely coiled and placed between the wrists and the sides of the neck. They were able to hiss and move slowly when picked from the rock.

Mr. Sherburne Cook, Jr., found a male *Corynorhinus* in an old cabin, 10 miles east of Stewart's Point, Sonoma County, on November 14, 1943. It was clinging to a rough wooden wall.

A male was found at Mission San Jose, Alameda County, on January 2, 1943. It was clinging tightly to a vertical wall, holding on with both feet and thumbs. Outside temperatures were near 32° F., for frost lay upon the ground. It was noticeably warmer inside the mission building. The bat was too stiff to squirm when first plucked from the wall. It was put in a pocket and, a minute or so later, was completely active.

The cause of dormancy in *Corynorhinus* is not clear. It seems to be involuntary within certain temperature limits. Captive specimens were placed in a refrigerator at a temperature of 40° F. All became dormant within 20 minutes. When disturbed, but not removed, they were able only to squirm feebly. They seemed to become dormant automatically at this temperature.

No dormant *Corynorhinus* were ever found in retreats that were warm. All those found in the attics of buildings on warm days were active. Dormancy may not be possible when temperatures are above a certain minimum.

Between these two extremes are temperatures recorded in field notes as "cool". Though admittedly indefinite, the term probably expresses a relatively narrow temperature range. Every dormant *Corynorhinus* found was in a cool place.

Active bats also were found in cool retreats. Some active individuals were in mine tunnels where the actual temperature was lower than in other cool retreats where dormant *Corynorhinus* were found. Both active and dormant specimens were found in retreats that were very humid and in others that were very dry. Humidity seems not to be a factor.

### PARASITES AND ENEMIES

Specimens of *Corynorhinus* were not examined for internal parasites, but any ectoparasites present were usually noted. No fleas, ticks, lice, mites, or bedbugs were found. Some specimens were apparently free of ectoparasites. Winged flies (streblids) were not uncommonly found. Never more than one was noted on a bat. Wingless flies (nycteribiids) were most common. As many as five have been removed from one specimen.

No injured or diseased bats were found. F. Hooper (MS 1939) found a hibernating *Corynorhinus* that appeared to be sick. One ear seemed to be infected and a portion of it was missing.

There are no records of any vertebrate preying on *Corynorhinus* in California. The late hour at which they hunt, and the speed and agility of their flight, probably keep them safe from most predators. Active bats in their daytime retreats are quick to take flight when molested. They usually choose an overhead or vertical surface at some distance from the ground to cling to when dormant.

Their retreats are usually in places not often visited by humans. Their habit of taking flight at the least alarm, however, calls them to the attention of any person entering their retreat. In most instances the bats escape capture but some are killed, especially by miners.

The mummified bodies of *Corynorhinus* are occasionally found on the floor beneath a favored retreat. These presumably died from natural causes.

### LITERATURE CITED

ALLEN, GLOVER M. 1916. Bats of the genus *Corynorhinus*. Mus. Comp. Zool. Bull. 60, pp. 333–356.

GRINNELL, H. W. 1918. A synopsis of the bats of California. Univ. California Publ. Zool., vol. 17, pp. 223-404.

GRINNELL, J. AND H. S. SWARTH. 1913. An account of the birds and mammals of the San Jacinto area of southern California, with remarks on the behavior of geographic races on the margins of their habitats. Univ. California Publ. Zool., vol. 10, pp. 197–406.

STEPHENS, FRANK. 1906. California mammals. (San Diego, West Coast Publishing Co.), pp. 1–351.

WHITLOW, W. B. AND E. R. HALL, 1933. Mammals of the Pocatello region of southeastern Idaho. Univ. California Publ. Zool., vol. 40, pp. 235–276.

*Museum of Vertebrate Zoology, University of California, Berkeley, California.*

# PATERNAL CARE OF YOUNG MICE OF THE GENUS PEROMYSCUS*

By B. Elizabeth Horner

In the literature of social relations in *Peromyscus* there seems to be general agreement that a female with a young litter frequently will not tolerate the presence of other adults in the same nest with the young (Dice, 1929; Svihla, 1932; and Blair, 1941). Blair (*op. cit.*), in his study of captive *Baiomys taylori subater*, a form closely related to *Peromyscus*, noted that the *Baiomys* female parent is more tolerant of other adults placed in the same cage than is the female parent in *Peromyscus*. In *Baiomys* he found also that the male parent may actually assist in the care of the young. To my knowledge, however, no descriptions of paternal care of the young have yet been given for *Peromyscus*. The following observations, made in the Laboratory of Vertebrate Biology of the University of Michigan and at Smith College, are therefore of interest.

One male, descended from a stock of *Peromyscus maniculatus bairdii* trapped by Merrel A. Taylor near Fennville, Michigan, was observed to assist his mate with the care of three different litters. The nest in each case was located in a half-pint, broad-mouthed jar, and the nesting material consisted of paper which had been finely shredded by the two adults. Although the birth of these three litters was not observed, the time of birth was known to within approximately twenty-four hours; and in each case the male was in the same nest with the female and young when the latter were still no more than 26 hours old.

When the first litter was between two and three days of age the nest was opened for observational purposes, and both parents appeared equally solicitous of the young mice. At first they seemed reluctant to expose the young, the two adults lying close together and covering them completely. Within a minute or two, however, the parents shifted their positions slightly, and both were seen to wash the young by licking them. Observations made when another litter was not more than one day old showed that the male, whenever the nest was opened, would pull the nesting material back over the whole family, the female continuing all the while to nurse the young. Once when the female went away from the nest for a minute or two, leaving the male and the young behind, the male picked up one of the young in his paws and washed it just as the female might have washed it. When a third litter was between one and two days old, the male, during a brief absence of the female from the nest, washed the young and then tucked them under his body and kept them there. Later, when small pieces of paper were introduced into the cage, he rapidly shredded the paper with his teeth and added it to the already present supply of nesting material.

My next observations of paternal behavior were perhaps even more interesting. They involved three different males of *Peromyscus maniculatus gracilis*, all descended from a stock trapped at Pine Lake, Alger County, Michigan, by W. F. Blair. Each of these male parents was seen on several occasions to pick up in its

* Contribution from the Laboratory of Vertebrate Biology, University of Michigan and Contribution No. 214 from the Department of Zoology, Smith College.

The writer is grateful to Dr. Lee R. Dice for his critical reading of the manuscript.

mouth a young mouse and then to run a few times about the cage with it grasped firmly, but apparently gently, between its teeth. Such behavior is not uncommon in female parents, but I can find no record of its having been observed previously in males. My notes indicate that the manner in which the male picked up and carried the young differed in no apparent way from similar behavior on the part of his mate. Often a male would carry one young about the cage for awhile and then either return it to the nest or deposit it at some convenient spot outside the nest, soon to pick up another one and carry it about in similar manner. In no case did the female appear to show any antagonism toward this behavior of the male. Usually she seemed not to notice it, although occasionally she would take the young away from the male and then either return it to the nest or run about the cage with it herself. Under such circumstances the male usually gave up the young willingly, promptly placing it on the floor of the cage for her to pick up. Occasionally he would try to dodge her nudgings, but even then would soon surrender the young if the female persisted in the chase.

With one unusual exception, to be described later, I have never witnessed any harm done to the offspring as a result of the male's carrying one about or failing to surrender it immediately to his pursuing mate. The age of the young observed to be carried about by the male varied from 5 to 18 days (excluding the above-noted exception). Possibly the young are carried about at an even earlier age; but 18 days is certainly very close to the maximum age at which they can be transported in the described manner, for at that age they are rather cumbersome packages. Those observed were so large that the male had to hold his head awkwardly high as he carried them, and they were so active that he usually experienced considerable difficulty in obtaining an adequate hold on them as they scampered and climbed about.

Whether this particular type of parental behavior is actually of any benefit to the young is open to speculation. The *gracilis* parents here described seemed to enjoy running about in this manner and did it frequently even when apparently undisturbed. Moreover, they often ran about in similar manner with sunflower seeds in their mouths, whether or not a litter was present.

Further observations have been made, however, of several forms of paternal care, which, if they actually exist under natural conditions, may presumably be of adaptive significance. Such behavior has been manifested by two of the above-mentioned *gracilis* males. By way of illustration I shall describe the behavior of one male only, since it differed in no significant way from that of the other.

The cage used in rearing *Peromyscus* at the Laboratory of Vertebrate Biology has been described by Dice (*op.cit.*). In the same paper he described also the nest pan. This is a one-quart pan with the handle removed and an opening, or doorway, cut into one region. Such a nest pan, which is commonly referred to in the Laboratory as an "igloo," is placed upside down in the cage of each mated female. A female with a litter will usually locate her nest under the igloo, entering and leaving the nest through the doorway.

One day, five days after the birth of a litter of three young to this *gracilis* male

and his mate, I removed the igloo from the cage for a few minutes, thereby exposing the entire family lying together in a depression in the cotton. The female, after turning a few backward somersaults, carried the three young to one corner of the cage and then returned to her somersaulting. Almost immediately the male went to the same corner of the cage, picked up one of the young in his mouth, promptly set it down again, and then spread himself over all three of them in the hovering position described by Huestis (1933) with reference to maternal behavior in *Peromyscus*. While still in this apparently protective position he later placed one of his fore feet on one of the young to hold it still while he carefully licked its genital region.

A few days later, when the young were 11 days old, I moved the igloo three different times in the course of the afternoon from one position in the cage to another, each time exposing the parents and offspring as they lay together in the nest. On each of these occasions the parents completed the moving of the young into the igloo again within five minutes or so. Both parents participated in the moving procedure, the male being perhaps a little slower than the female but carrying at least one young into the igloo upon each occasion. When the young had been placed in the igloo, the male each time remained there with them while the female ran about the cage for awhile. She ran about, sometimes in large circles, sometimes turning backward somersaults, and sometimes climbing the side of the cage toward the observer in response to a sound which the observer made and which the adult mice had learned to associate with offerings of sunflower seeds. The female would engage in such activity for anywhere from 30 to 60 minutes after the young had been placed in the igloo, visiting them only occasionally and briefly. All this time the male remained under the igloo with the litter, never once extending more than his head and shoulders beyond the doorway, and then doing so only to pull an adventurous youngster back into the igloo or to pick up a seed dropped close to the doorway by the observer. The reaction of the male to sunflower seeds while staying with the young is of particular significance, for he was normally (that is, when not watching over the young) just as responsive to the sunflower seed signal as was the female; yet, while keeping his vigil over the young, he never left the igloo to come to the front of the cage for a seed. That he actually heard the signal was demonstrated by the fact that he several times extended his nose from the igloo when the signal was given; but he took seeds only when they were placed close to the doorway.

These several manifestations of paternal care of the young, namely, the hovering of the male over the young, the occasional licking of the young, the carrying of young to a new nesting place upon disruption of the old, the keeping together of the young, and the remaining with them, have been similarly exhibited, as already mentioned, by each of two *gracilis* males. It is worthy of note that in one instance when a litter of seven was present, one of these males would occasionally be found sitting apart from the nursing female with the seventh young beneath his body. The female, of course, could nurse only six mice simultaneously. From time to time the young would be carried about and re-sorted (probably by chance) so that all were adequately nourished.

Since my notes on paternal care of the young result entirely from original chance observations rather than from a planned study of such behavior, I can furnish no data on the proportion of the males exhibiting it. However, that such behavior is subject, under certain conditions, to modifiability has been observed in the case of the last-mentioned *gracilis* male, this being the exceptional case referred to earlier.

In moving and opening the cage one day just as a markedly gravid female was about to give birth to a litter, I disturbed her mate and the four immature young of a previous litter, all of whom had been sleeping peacefully quite apart from the female. The six mice immediately began to run excitedly about the cage. Three or four minutes later, as the female was giving birth to the first young of her new litter, the male, who was nosing about at her perineum, suddenly grabbed the half-emerged young from her body and ran away with it in his mouth. Since this first young was accompanied by considerable bloody-appearing material and since I saw no other indication of an afterbirth, it seems probable that the male secured the afterbirth as well as the young itself. He promptly began to eat the young. The female, after carefully washing her genitalia and paws, gave chase. Only once did she succeed in retrieving her offspring; and then, after she had chewed at the partly eaten object for a second or two, the male once more took it from her, this time eating it to completion. Four more young were soon born. The female washed none of them and left them scattered about the cage wherever they happened to be born. She ate only one afterbirth, leaving the others on the floor of the cage. For some time following the birth of the litter both parents ran very actively about the cage. About two hours after the birth of the first young, the male chanced upon an afterbirth, ate it, and then promptly ate part of a nearby young. Forty minutes later the female ate the remainder of this same young and very soon went on to eat the rest of the new litter.

The eating of these young by the parents very probably is explained to some extent by the great excitement attending the birth of the new litter. The cage was in a strange place, under stronger light than usual, and five mice were running about the cage while the young were being born. The crowded conditions may also have affected the behavior of the mice. Possibly, too, the presence of blood on the female and on the first-born young may have set up a reaction in the male which favored his eating this young; and possibly the female's excitement and/or her chewing on the first, partly eaten young stimulated her to behave as she did. Whatever the explanation, it is apparent that under certain conditions mice which are usually good parents may exhibit abnormal behavior.

Two cases of paternal care of the young remain to be described, one in *Peromyscus maniculatus nebrascensis* and the other in *P. leucopus noveboracensis*. The *nebrascensis* male was descended from a stock trapped by B. T. Ostenson and P. R. Sime at Kennedy, Nebraska. As I walked past the cage of this male parent one day, I noticed that he was sitting in a corner of the cage giving one of his 24-day-old offspring a bath, licking thoroughly its entire body. His fore feet were placed lightly on the young mouse and were being used merely to assist in maneuvering the latter into desired positions, for the offspring offered no

resistance to its father's actions. The cage was then removed from the rack, and examination showed the female to be under the igloo nursing the other two young of the same litter.

In the case of *P. l. noveboracensis* it is of particular interest that the male concerned was wild-caught, having been trapped by E. C. Driver at Northampton, Massachusetts. This male, although not actually the father of the offspring concerned, was the only male present in the cage with the female when the single young was born. When the young mouse was 22 days old I removed it from the cage for about ten minutes. Upon its return both the male and the female seemed very much excited, and both began promptly to lick it. A few seconds later the male grabbed its dorsal shoulder region with his teeth and half carried, half dragged it toward the door of the igloo. However, he soon lost his grip on the fairly well-grown and very active young. The female then attempted to do just as the male had done, but the offspring soon broke away from her hold. As it ran off, the male once more grasped it as before and this time backed into the igloo, pulling the struggling youngster along with him. The male then remained under the igloo with the young mouse while the female ran about the cage for several minutes in a very excited manner.

Few though they are, the foregoing observations of paternal care of the young indicate that such care occasionally does exist in the laboratory in certain forms of *Peromyscus*. My original observation of such behavior on the part of each male described was, as previously noted, a chance one. However, it is perhaps suggestive that although I have worked with five species and ten subspecies, I have chanced upon this behavior only in the four forms here recorded. In *gracilis* I have found two males exhibiting true paternal care of the young plus an additional male showing at least some degree of paternal interest in the young in that he repeatedly carried them about in his mouth. In each of *bairdii*, *nebrascensis*, and *noveboracensis* I have come upon one male which assisted in the care of the young. The number of mated males with litters which I have had in my care does not exceed 6 in either *gracilis* or *noveboracensis*, 10 in *bairdii*, or 11 in *nebrascensis*. In the other six subspecies it has varied from 1 to 9. This might be considered as circumstantial evidence that paternal care of the young is more common among *gracilis* males than among those of some of the other subspecies with which I have worked. This evidence, based upon small numbers, and purely circumstantial though it is, is in accord with Blair's conclusion that *Peromyscus maniculatus gracilis* individuals are very tolerant of one another in nature (Blair, 1942).

These observations on paternal behavior in *Peromyscus* suggest the possibility that these animals are more social than has usually been assumed, and it may well be that the association of the male with the family group is of greater permanency and of more widespread occurrence in these rodents than has previously been suspected. Furthermore, if such behavior actually does occur under natural conditions the assumption by the male of some responsibility for the welfare of the young would presumably be of adaptive value for the species.

LITERATURE CITED

BLAIR, W. FRANK. 1941. Observations on the life history of *Baiomys taylori subater*. Jour. Mamm., vol. 22, pp. 378–383.

——— 1942. Size of home range and notes on the life history of the woodland deer-mouse and eastern chipmunk in northern Michigan. Jour. Mamm., vol. 23, pp. 27–36.

DICE, LEE R. 1929. A new laboratory cage for small mammals, with notes on methods of rearing *Peromyscus*. Jour. Mamm., vol. 10, pp. 116–124.

HUESTIS, R. R. 1933. Maternal behavior in the deer mouse. Jour. Mamm., vol. 14, pp. 47–49.

SVIHLA, ARTHUR. 1932. A comparative life history study of the mice of the genus *Peromyscus*. Misc. Publ., Univ. Michigan Mus. Zool, no. 24, 39 pp.

*Department of Zoology, Smith College, Northampton, Massachusetts.*

## A DEER-COYOTE EPISODE

BY VICTOR H. CAHALANE

Most accounts of the destruction of deer by coyotes are circumstantial, being inferred from evidence on the ground and from the remains of the victims. The following concerns a killing which occurred under exceptionally favorable circumstances for observation. It is written from notes which were made within two hours after the incident.

Late in the afternoon of November 2, 1943, I was walking on the trail which parallels the south rim of the Grand Canyon between Yavapai Observation Station and Grand Canyon village, in Grand Canyon National Park. A few rods south of the rim, the ground slopes about 30 degrees downward to the bottom of a broad draw, then rises more gradually again. For about one-half mile east of the village, the highway to Cameron, Arizona, is located in this draw, some 150 to 200 yards from the canyon rim. The southern slope of the draw is covered with a mature stand of ponderosa (Arizona) pine. Much of the north slope between the highway and the rim is more open. Except for scattered ponderosa and pinyon pines and patches of scrub oak, the vegetation is mostly grasses, low shrubs such as sagebrush, and cliff rose.

About 6 p.m., when I was approximately one-quarter mile east of the village, I heard a deer scream hoarsely. The sound was very loud and was repeated several times. It seemed to come from the south slope of the draw. Almost immediately I heard briefly the sound of numerous hoofs pounding across the macadam road in the bottom of the draw. A few seconds later a band of mule deer (*Odocoileus hemionus*) burst into sight over the crest a short distance away. The animals were racing almost directly toward me and obviously were greatly excited. With a single exception, as they saw me they veered off to the west parallel to the rim of the canyon and ran out of sight.

One doe, which I judged to be a yearling, was about 5 yards behind the others. She brushed around the upper side of a scrub pinyon and turned back into the draw. In the brief glimpse I was permitted as the doe flashed by about 25

yards away, I saw a gray furry animal partly clinging to, and partly galloping beside her right hip. Running after them, I perceived that the attacker was a coyote (*Canis latrans*). On the lower slope, two other coyotes were maneuvering into position to intercept the fleeing doe. The latter ran downhill at a quartering angle and the two ambushers, barking in high excitement, met her. I could not see clearly exactly what happened, but the two ambushers seemed to endeavor to trip the victim. In any event, the deer stumbled, went down on her left side, and did not rise again.

This chase of deer by coyotes had followed a common pattern. The doe had been pursued to the top of a slope, turned downhill, and over-ridden or tripped on the down-grade. There her footing would be less secure than on level ground and the advantage would shift more heavily in favor of the aggressors.

The spot where the deer went down was near the top of a four-foot cut on the north side of the roadway. The ground was gently sloping and was covered sparsely with low sagebrush. I took advantage of the absorption of the coyotes in their prey to run toward them until I was about 60 yards away. There I crouched on the hillside above them and, with a clear view, watched developments.

The predators were wildly excited. One coyote, possibly the one that I had seen first, concentrated on cutting further into the body cavity in the region of the groin. Possibly an opening had been made during the pursuit, as the attacker appeared to have been biting at this area. Its companions jumped about, yapping and growling, shifting from one point to another on the hind quarters. They bit and hacked chiefly at the rear of the lower right hip. In a few minutes they had damaged the lower portions of the muscles so badly that the leg was obviously useless. It dangled or swung limply as the coyotes pulled at it or brushed against it. The deer, however, had not made any effective efforts to regain her feet. She struggled but feebly and bleated hoarsely, especially as the coyotes made inroads on the groin and hip muscles. At one point she raised head and neck almost upright, at right angles to her shoulders. Thereupon one of the coyotes ran forward, reached up and grasped the base of an ear, and brought the deer's head back to the ground. This was done without any show of force or savagery, and as soon as the deer's head was flat on the ground the coyote released its hold and returned to the rear quarters. Except for this interruption, the coyotes appeared to pay but slight attention to the ineffective struggles and cries of their victim.

After a few minutes, I became aware that a band of seven deer were also deeply absorbed spectators of the scene. Six were does (adults or yearlings), while the seventh was a fawn. They were slowly advancing down the slope, coming from the direction in which the companions of the coyotes' victim had fled. It seems reasonable to suppose that they were in fact the same animals.

The hoarse bleats of the dying deer appeared to agitate them greatly. So intent were they on their unfortunate fellow that they apparently did not notice me, although I sat in plain sight less than 50 yards away. With each series of bleats they surged forward a few yards, stamping and whistling, until they were grouped only 10 yards up the slope from the victim. As they drew near, the

coyotes showed increasing uneasiness. They glanced up frequently, snapped more hurriedly at the prone body, and finally swung around in order to face this possible source of danger.

The precaution was well advised. The largest doe took the offensive several times. Lunging into the midst of the coyotes, she struck vigorously with her front hoofs together. With ears laid back and eyes protruding, she was transformed into a veritable Fury. Each time that she singled out a coyote and charged, that animal beat a hasty retreat, sometimes backing off 8 or 10 yards. During this cringing and hauling away from danger, the aimless struggles of the dying deer finally caused it to tumble down the bank onto the road-shoulder.

Immediately all the deer rushed to the top of the bank. Snorting and stamping, most of them stood there in helpless excitement. The largest doe, however, leaped again into the midst of the coyotes. She was closely followed by her biggest companion, who stood still near the prone animal. Not content with merely passive resistance, the leader struck out furiously with her front feet and drove all three coyotes ahead of her until she stood between them and their victim. It appeared that she might have won the upper hand, but one of the predators circled around to her rear. This threat was too serious—she wheeled and hastily scrambled back up the bank, closely followed by her supporter. This defeat seemed to convince the deer of their ineffectiveness. With lessening signs of excitement, they slowly retreated up the slope and out of sight.

Several times during the next few minutes the dying deer shrieked loudly in pain as the coyotes hacked and tore at its flesh. It had not made the slightest discernible movement, however, since tumbling down the road cut. The bleats soon decreased in volume and ceased entirely an estimated 20 minutes after the deer had been pulled to the ground.

Although I was not so fortunate as to see the actual beginning of this episode, it is my belief that the chase was short. Apparently I heard the first bleats given by the victim when it was attacked, for the sounds did not grow in volume as though approaching from a distance. Furthermore, none of the deer seemed winded when they passed me with the lone coyote in pursuit. They whistled in fright or anger but their mouths were closed and they breathed through their nostrils in a normal manner.

Almost as soon as the deer died, dissension began to develop among the coyotes. One of them, a female, was very lame in the left front leg. In the deepening dusk I could not be sure that a portion of the foot was missing, but this seemed to be the case. This animal, which I now named "Peg-leg," grew hostile toward her companions. Growling fiercely, she finally lunged at them and drove them away from the carcass. After a feeble effort at defense, they gave up. One walked in my direction, climbed the road-cut and lay down in the scrub sagebrush about 15 yards from the kill. The second coyote went in the opposite direction for about 70 yards and lay down under the large pines. Peg-leg continued to tear at the rear of the lifeless deer, and after a few minutes began to pull it across the highway. The carcass was almost too heavy and the crippled coyote, pulling backward with three legs, was able to move it only a few inches at each jerk. She

did some feeding in the process, and was successful eventually in getting the body onto the opposite (south) road shoulder. Shortly thereafter, Peg-leg pulled a chunk of meat away from the rear of one hip and carried it a little way into the pines. Laying down the meat, which weighed perhaps a pound, she got down first on one side and then on the other, using her hind feet to push the sides of her face and neck through the pine needles and sparse grass in order to clean the soiled fur. Again picking up the meat, she trotted unhurriedly eastward up the draw and passed out of sight among the trees. As she went, she held her left front foot stiffly at a slight angle ahead, in order to prevent the injured foot or stub from touching the ground.

As Peg-leg completed her brief toilet and started off, presumably to cache the piece of venison, the coyote nearest me arose, walked to the rear of the carcass, and commenced to pull it further from the road. I could not determine whether, with four capable legs, it was able to make better progress than the crippled female. After ten minutes the coyote that had been lying under the trees got up and joined its companion. There was a little snarling, and the coyote in possession made several passes with open mouth and bared teeth. This seemed to be a bluff, however, for after a short time the two coyotes were feeding together on the rear of the carcass in apparent amity.

Then I saw Peg-leg returning over the same route she had taken to the east. The two coyotes at the carcass soon sensed her, and intermittently watched her approach. She lay down when about 15 yards away but after five minutes she became impatient and moved in. There was more bluffing and snarling. The two weaker coyotes tried to ingratiate themselves with Peg-leg, but she continued to snap at them angrily. At times, all three coyotes were biting and pulling at the carcass. One of the weaker animals moved to the less desirable position on the neck and forequarters but the growling and snarling continued. Possibly the danger of being bitten overpowered partly-satisfied appetite. In any event, the two coyotes moved away into the dusk under the pines and left Peg-leg in undisputed possession.

By this time, the darkness was too intense to make further observation worth while. The following morning I returned to the scene and found that the remains of the deer had been dragged south through the open forest for approximately 200 yards. There the trail of scattered hair ended. Presumably the carcass was so reduced and torn to pieces as to make it possible for a predator to pick up and carry off the last remnant without permitting it to drag on the ground.

*National Park Service, Chicago 54, Illinois.*

# NOTES ON MEXICAN MAMMALS

BY EMMET T. HOOPER

Among the collections of mammals recently acquired by the Museum of Zoology of the University of Michigan are several lots from Mexico. The following notes result from the routine study, in preparing the specimens for insertion in the main collection of the Museum, of 900 of the specimens. Most of these here reported on were collected by Helmuth O. Wagner who worked chiefly in the State of Mexico and the Federal District, but who also obtained a few specimens in Chiapas, Oaxaca, Puebla, Guerrero, Hidalgo, Morelos, Nuevo León, and Tamaulipas. A few specimens from Chiapas were obtained by Pierce Brodkorb, Irving Cantrall, Norman Hartweg, and Arthur Staebler incidental to their studies of other groups of animals for the Museum of Zoology.

This material is of interest because it provides new records of occurrence of some species in Mexico, where knowledge of the distribution of mammal kinds and analysis of the factors influencing their distribution is far from complete. Some of the specimens come from areas, for example the vicinity of Prusia in the Sierra Madre of Chiapas, whence previously no mammals had been collected for scientific study. In addition, the material brings to collections examples of a few heretofore unrecognized geographic races of small mammals.

In the following accounts all measurements are in millimeters. Capitalized color terms are from Ridgway (1912). A vernacular name is supplied for each species except those which eventually probably will be found to be conspecific, for example some species of *Sciurus*, and those which have no conspicuous external peculiarity easily recognizable by the novice or dilettante. In such instances a common name for the genus seems to suffice. Patronal names are avoided. For the use of certain specimens contained in the collections of the U. S. Fish and Wildlife Service (herein abbreviated "U. S."), the Dickey Collections of the University of California at Los Angeles (abbreviated U. C.), and the Texas Cooperative Wildlife Collection (abbreviated "Tex.") I thank Hartley H. T. Jackson, A. J. van Rossem, and William B. Davis, respectively in charge of those collections.

In the following descriptions of collecting stations all distances are map distances, not mileage by highway or railway. Distances from Mexico City are measured approximately from the center of the city.

**Chiapas**

Arriaga. A town in arid tropical zone at the base of the Sierra Madre, 22 kilometers northwest of Tonalá, elevation about 50 meters. Specimens were collected on the hill back of town at an elevation of 100 meters.

Catarina. An anexo of Finca Prusia, about 8 kilometers west of Prusia, elevation 1300 meters.

Cerro Ovando. A cerro in the Sierra Madre, 11 kilometers north of Escuintla. All specimens were collected in cloud forest at elevations of 1775–2100 meters.

Comitán. Specimens were collected in the vicinity of the town in short grass and scrub oak at an elevation of 1500 meters.

Finca Esperanza. A coffee and cattle finca 6 kilometers northeast of Escuintla in humid tropical climate. Collections were made at elevations of 145–250 meters.

Finca Juárez. A coffee finca on the Pacific side of the Sierra Madre, about 14 kilometers east of Escuintla. Specimens were collected at 1200 meters elevation.

Huehuetán. A town on the railroad 19 kilometers northwest of Tapachula, elevation 40 meters. Humid tropical.

Mapastepec. A village on the hot, humid coastal plain 90 kilometers northwest of Tapachula, elevation 50 meters.

Pijijiapan. A village at the base of the Sierra Madre 72 kilometers southeast of Tonalá, altitude 50 meters. Arid tropical.

Prusia. A coffee finca in rain forest on the inland slope of the Sierra Madre about 38 kilometers northeast of Mapastepec. Wagner collected at elevations of 1000–1100 meters.

Suchiate. A town on the Mexico-Guatemala border, elevation 50 meters. Humid tropical.

Tonalá. Specimens were collected near town in mixed acacia scrub and grassland, elevation 50 meters. Arid tropical.

Triunfo. A locality about 10 kilometers south of Prusia on the trail from Prusia to Mapastepec, elevation 1950 meters. In cloud forest on Atlantic side of the Sierra Madre.

Tuxtla Gutiérrez, 10–11 kilometers west. Collections were made at elevations of 800–1000 meters. Arid tropical.

Volcán de Tacaná. A volcano in the Sierra Madre, on the Mexico-Guatemala border, 50 kilometers north of Suchiate. Collections were made at several locations within the pine and hardwood forests, elevations 2600–3800 meters.

**Distrito Federal**

Colonia del Valle. A colonia in the southern part of Mexico City, elevation approximately 2275 meters.

Contreras. A town on the railroad to Cuernavaca 15 kilometers south-southwest of Mexico City, elevation 2600 meters.

Coyoacán. A city 10 kilometers south of Mexico City. Wagner collected in the vicinity at elevations of 2350–2380 meters.

Cruz de Coloxtitla. A monument on the Desierto de los Leones and trail to Cerro San Miguel, about 25 kilometers southwest of Mexico City, elevation 3600 meters.

La Cima. A village near the crest of the divide, 2900 meters elevation, 35 kilometers south-southwest of Mexico City on the Cuernavaca highway.

Milpa Alta. A town about 30 kilometers south-southeast of Mexico City. Wagner collected in the vicinity at elevations of 2400–2600 meters.

Portillo de Santa Rosa. A pass on the flanks of Monte Santa Rosa, about 22 kilometers southwest of Mexico City. Wagner collected at altitudes of 3100–3300 meters.

San Bartolomé. A village about 16 kilometers southwest of Mexico City and 3 kilometers northwest of Contreras. Wagner collected in the vicinity at elevations of 2800–2900 meters.

San Gerónimo. A village 14 kilometers south-southwest of Mexico City on the railroad to Cuernavaca. Wagner colleced on the pedregal near San Gerónimo at elevations of 2400–2600 meters.

San Mathens. A village 23 kilometers southwest of Mexico City, elevation 2800 meters. San Mathens, as used by Wagner, is near or identical with San Mateo Tlaltenango, as found on some maps.

Santa Rosa. A village about 2700 meters in elevation, 24 kilometers southwest of Mexico City and 5 kilometers west-northwest of Contreras.

Tepepan. A village 22 kilometers south of Mexico City and 5 kilometers east-southeast of Tlalpam, elevation about 2250 meters.

Tlalpam. A city about 14 kilometers south of Mexico City, elevation 2250 meters.

Xochimilco. A town 20 kilometers south-southeast of Mexico City, elevation 2400 meters.

**Guerrero**

Chilpancingo. A town 1360 meters in elevation in the Sierra Madre, on the Mexico City-Acapulco highway.

**Hidalgo**

Actopan. A town in southern Hidalgo, 15 kilometers northwest of Pachuca, elevation 2050 meters.

**México**

Ixtaccihuatl. A peak 60 kilometers southeast of Mexico City. Wagner collected on the west slope at an elevation of 2500 meters.

Lerma. A town located at the junction of the Mexico City-Toluca highway and the Río Lerma, elevation about 2600 meters.

Rancho Córdoba. A ranch in pine woods 35 kilometers east-southeast of Mexico City on the Mexico City-Puebla highway. Probably corresponds to Córdova on some maps. Wagner collected on the ranch at elevations of 2560–2700 meters.

Río Frío. A village at about the highest point on the Mexico City-Puebla highway, near the Puebla state line. Elevation 3000 meters where Wagner collected.

Temascaltepec. A town 50 kilometers southwest of Toluca, elevation 1744 meters. Wagner gives 1600 meters as the elevations of areas where he trapped.

Zempoala. A lake 37 kilometers south-southwest of Mexico City, elevation 3200 meters. Although located by Wagner in Morelos, this collecting locality of his may have been within Estado de México. Zempoala is near the Morelos-Mexico state boundary, but in the state of Mexico.

**Morelos**

Cuernavaca. The capital of Morelos, elevation 1500 meters.

**Nuevo León**

Galeana, 20 kilometers north. In the Sierra Madre Oriental. Wagner gives 7000 feet (2134 meters) as the elevation of this collecting locality.

General Terán, 20 kilometers northwest. On the plain atthe eastern base of the Sierra Madre Oriental, elevation 900 feet (275 meters).

**Oaxaca**

Teotitlán. A town adjoining the Puebla state line in northern Oaxaca, near the Puebla-Oaxaca City railway, elevation 950–1000 meters.

**Puebla**

Tehuacán. A town on the Puebla-Oaxaca City railroad, 45 kilometers north of the point where the railroad crosses the Oaxaca state border, elevation about 1700 meters.

Tepanco. A village on the Puebla-Tehuacán highway, 20 kilometers northwest of Tehuacán, elevation about 1800 meters.

**Tamaulipas**

Acuña. A village 800 meters in elevation in the Sierra de Tamaulipas, 93 kilometers southeast of Ciudad Victoria and 48 kilometers northwest of Aldama.

**Vera Cruz**

Portrero Viejo. A sugar plantation 13 kilometers north-northeast of Córdoba, altitude 530 meters.

## ACCOUNTS OF SPECIES

**Didelphis mesamericana tabascensis** Allen.—Opossum

*Specimens.—Chiapas:* Catarina, 1300 m, 8. *Morelos:* Cuernavaca, 1500 m, 1. Seven of the specimens are young, in black juvenile pelage and without fully emerged permanent molars. Two are adults, one a skull only, the other an adult female in the gray color phase. The specimens are identified as *tabascensis* on a geographic basis only.

**Marmosa canescens canescens** Allen.—Gray Murine Opossum

*Specimen.—Puebla:* Tehuacán, 1700 m, 1. The distal part (about 20 mm) of the tail is whitish. The pelage is well worn.

**Marmosa mexicana mexicana** Merriam.—Mexican Murine Opossum

*Specimens.—Chiapas:* Prusia, 1100 m, 1; Catarina, 1300 m, 1.

**Sorex saussurei saussurei** Merriam.—Long-tailed Shrew

*Specimens.—Distrito Federal:* Portillo de Santa Rosa, 3100 m, 1; San Bartolomé, 2900 m, 1; San Mathens, 2800 m, 1; San Gerónimo, 2600 m, 1; Contreras, 2600 m, 1.

**Cryptotis micrura** Tomes.—Least Shrew

*Specimens.—Chiapas:* Prusia, 1000 m, 1; Finca Esperanza, 145 m, 1. The two specimens are small as in *Cryptotis micrura* (condylobasal length, 18.1 mm and 17.5 mm), and the specimen from Prusia agrees with the description of coloration given by Merriam (1895) for *micrura*. The specimen from Esperanza, however, is darker brown dorsally and ventrally and its rostrum is heavier and relatively broader. It may represent a new geographic race which inhabits the tropical lowlands of southern Chiapas.

**Choeroniscus godmani** Thomas.—Long-nosed Bat

*Specimen.—Chiapas:* Pijijiapan, 50 m, 1.

**Desmodus rotundus murinus** Wagner.—Vampire Bat

*Specimen.—Vera Cruz:* Portrero Viejo, 530 m, 1. The specimen was collected in a limestone cave at the edge of rain forest.

**Myotis nigricans nigricans** Wied.—Little Black Bat

*Specimen.—Chiapas:* Prusia, 1100 m, 1. Although collected much nearer the type locality of *M. n. extremus* Miller and Allen (1928) than *M. n. nigricans*, this specimen agrees best with *nigricans* in size, which is the principal character employed by Miller and Allen for differentiating the two. Pertinent measurements follow: greatest length of skull, 13.6 mm; length of mandible, 9.5 mm; mandibular tooth row, 5.4 mm.

**Rhogeëssa tumida** H. Allen.—Rhogeëssa Bat

*Specimens.—Chiapas:* Prusia, 1000 m, 3; near Huehuetán, 40 m, 1. The specimen from Huehuetán was collected in a moving railroad passenger car. The bat entered the car through an open window.

**Nasua narica narica** Linnaeus.—Coatimundi

*Specimens.—Chiapas:* Catarina, 1300 m, 1; Finca Esperanza, 200 m, 1; Cerro Ovando, 1800 m, 2. As pointed out earlier by Burt and Hooper (1941) individual, sexual, and age

variations in this species are sufficient to obscure most geographic variation that may be present. The four specimens listed above are similar to specimens from Vera Cruz, El Salvador, and Guatemala.

**Potos flavus campechensis** Nelson and Goldman.—Kinkajou

*Specimens.—Chiapas:* Finca Esperanza, 200 m, 3. The specimens are slightly darker than specimens of *campechensis* from the Department of Petén, Guatemala.

**Jentenkia sumichrasti variabilis** Peters.—Cacomistle

*Specimen.—Chiapas:* west slope Volcán de Tacaná, 2800 m, 1. In the absence of comparative material the specimen is referred to *variabilis* on a geographic basis only. It was collected in an upper cloud forest of pines and hardwoods.

**Mustela frenata goldmani** Merriam.—Long-tailed Weasel

*Specimen.—Chiapas:* Triunfo, 1950 m, 1.

**Urocyon cinereoargenteus guatemalae** Miller.—Gray Fox

*Specimens.—Chiapas:* Finca Esperanza, 200 m, 1; Prusia, 1200 m, 1; vicinity of Suchiate, 50 m, 1; vicinity of Tonalá, 50 m, 1. The specimen from Suchiate was purchased from a native who reported that he collected it near Suchiate.

**Citellus variegatus variegatus** Erxleben.—Rock Squirrel

*Specimens.—Hidalgo:* Actopan, 2050 m, 1. *Puebla:* Tehuacán, 1700 m, 1.

**Citellus mexicanus mexicanus** Erxleben.—Mexican Ground Squirrel

*Specimens.—Distrito Federal:* Coyoacán, 2350 m, 4.

**Sciurus deppei deppei** Peters.—Pine Squirrel

*Specimens.—Chiapas:* Volcán de Tacaná, 2600–2800 m, 6; Finca Juárez, 1200 m, 1; Cerro Ovando, 1800–2100 m, 6; Triunfo, 1950 m, 6. The specimens from Tacaná, which is higher than the other localities, have longer pelage than the other specimens and are rusty rufous ventrally rather than whitish.

**Sciurus aureogaster aureogaster** F. Cuvier.—Tree Squirrel

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 1; 20 km NW General Terán, 900 ft., 1. Both specimens are melanistic, one completely black, the other black diluted to dull brown on the flanks and medial part of the tail.

**Sciurus nelsoni nelsoni** Merriam.—Tree Squirrel

*Specimens.—Distrito Federal:* Cruz de Coloxtitla, 3600 m, 1; Santa Rosa, 2700 m, 2. *México:* Rancho Córdoba, 2700 m, 1. Two are in gray phase, two in black phase. In the black specimens the buffy bands of the hairs are about one-half the width of comparable bands in the gray individuals and the black bands are correspondingly lengthened.

**Sciurus socialis socialis** Wagner.—Tree Squirrel

*Specimens.—Chiapas:* Arriaga, 100 m, 1; Mapastepec, 50 m, 1; 11 km W Tuxtla Gutiérrez, 800 m, 1. The three specimens have an indistinct rufous nape and are ferruginous ventrally. In the specimen from Tuxtla, in fresh summer pelage (April 23), the rusty color of the underparts extends about half-way up the sides, as in some specimens of *Sciurus aureogaster* from northern Mexico.

**Sciurus griseoflavus griseoflavus** Gray.—Tree Squirrel

*Specimens.—Chiapas:* Finca Juárez, 1200 m, 1; Volcán de Tacaná, 2600–3800 m, 4. Two of the specimens from Tacaná are partly melanistic, the darker color particularly noticeable on the upper parts and hind feet. They were collected in oak and pine cloud forests near timberline (3800 m).

**Sciurus variegatoides goldmani** Nelson.—Tree Squirrel

*Specimens.—Chiapas:* Finca Esperanza, 250 m, 2. Both fresh (July 26) and well worn pelages (March 3) are represented.

**Sciurus alleni** Nelson.—Tree Squirrel

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 2.

**Cratogeomys tylorhinus arvalis,** new subspecies.—Mexican Plateau Pocket Gopher

*Type.*—Adult female, skin and skull; University of Michigan Museum of Zoology no. 88222; México, Distrito Federal, Mexico City, Colonia del Valle, 2275 m; collected January 18, 1942, by Helmuth O. Wagner; original number 16.

*Distribution.*—Known only from the vicinity of Mexico City.

*Diagnosis and comparisons.*—A pocket gopher of the *platygeomys* group, characterized by moderate size, broad massive zygomata, large jugal, and small mastoid and auditory bullae. In many morphological features of skin and skull similar to *planiceps* and *tylorhinus*. Differs from *planiceps* in heavier zygomatic arch, well seen in much wider dorsal face of the maxillary arm, and larger jugal which is expanded anteriorly to form a broad, dorsolaterally directed plate; more sinuous lambdoidal ridge; narrower mastoid bullae (well seen from posterior aspect); and smaller less inflated auditory bullae. *C. t. arvalis* may also be smaller than *planiceps*; the hind foot of the two females of *planiceps* at hand measure 41 mm and 46 mm, as compared with the range 37–41 mm in seven females of *arvalis*. Similar in size and color to *tylorhinus*, but nasals longer (about 39 percent of basilar length in *arvalis*, 36 percent in *tylorhinus*); skull broader posteriorly (averaging 83 percent and 79 percent of basilar length, respectively, in *arvalis* and *tylorhinus*); mastoid bullae relatively smaller in transverse diameter and narrower and more attenuated laterally. Similar in size and color to *varius* but distinguishable by cranial characters as follows: base of rostrum rounded, not distinctly flattened dorsally; ascending branches of premaxillae extending farther posteriorly beyond nasals (about 3 mm, compared with 2 mm in *varius*) and truncate rather than acuminate at end; maxillary arm of zygomata of greater anteroposterior diameter, but expanded into a smaller plate at its lateral angle (junction with jugal); cranium much broader posteriorly (diameter across squamosals greater than 102 percent of zygomatic breadth in *arvalis* and less than 102 percent in *varius*); audital and mastoid bullae larger, the mastoid bullae prolonged laterally well beyond border of external auditory meatus (ending laterally approximately on plane with meatus in *varius*). Smaller than *gymnurus* and with relatively narrower and longer rostrum, less inflated cranium (well developed anterolaterally directed depression between sagittal crest and external auditory meatus); paroccipital processes relatively weaker; jugal relatively heavier (well seen in lateral aspect).

*Measurements.*—Averages and extremes (in millimeters) of seven adult females (parietal ridges approximated or fused to form sagittal crest) from Mexico City: Total length, 300 (288–315); tail vertebrae, 87 (76–98); hind foot, 39 (37–41); weight, 387 grams (270–510); basilar length of skull, 47.3 (46.1–48.4); condylobasal length, 54.2 (52.9–55.6); zygomatic breadth, 37.1 (35.3–38.7); greatest breadth of cranium across squamosals, 39.1 (37.5–40.8); interorbital breadth, 8.1 (7.9–8.4); length of nasals, 18.3 (17.5–19.2); length of cutting edge of both incisors, 6.8 (6.5–7.0); occipital depth, measured on median line from anterior lip of foramen magnum dorsally to posterior border of interparietal, 15.7 (15.2–16.3).

Averages and extremes of three adult males from Mexico City: total length, 323 (321–325); tail vertebrae, 93 (87–102); hind foot, 41 (37–43); weight, 487 grams (420–555); basilar length

of skull, 53.0 (50.9–55.6); condylobasal length, 60.2 (58.6–63.2); zygomatic breadth, 40.5 (39.8–41.3); breadth of skull, 44.0 (42.7–45.2); interorbital breadth, 8.8 (8.6–9.0); length of nasals, 21.0 (20.4–22.0); length of cutting edge of both incisors, 7.3 (7.2–7.5); occipital depth, 17.6 (16.8–18.6).

*Remarks.*—In the *platygeomys* group of pocket gophers the color of the pelage apparently is similar from place to place, but varies considerably with the season of the year and the weathering of the fur. In the series of specimens at hand, representing several localities and geographic races, I see no color differences which can be correlated with geography. There is, however, marked difference in color between the newly emerged short pelage and the long, worn pelage. The new pelage, predominantly seen in specimens of spring and summer collection, is dark brown—about Olive-Brown—over the upper parts and underparts, lightly washed with black on the back and with a concentration of black on the forehead and around the ears. Worn pelages are bright reddish brown—near Tawny—with essentially no black on the back or head and with small, black, circumauricular spots. This change in pelage coloration macroscopically appears to be due to abrasion of the black parts of the hairs, which removes most of the black from the back and head and reduces the auricular spots, and to an actual modification of the hair structure or chemical change in the pigment, perhaps an oxidation, which produces the paler brighter colors.

In his review of the *platygeomys* group Goldman (1939) recognized the similarity of *tylorhinus* and *planiceps* and indicated that intergradation of the two might well be expected. *C. t. arvalis*, although unique in some features, is similar to one or the other of the two forms in other characters and indicates subspecific relationship of the three forms. For status of the name *platygeomys* see Hooper (1946).

*Specimens examined.—Cratogeomys tylorhinus arvalis:* Distrito Federal: Coyoacán, 2350 m, 3; Mexico City, Colonia del Valle, 2275 m, 9. *C. t. tylorhinus:* Hidalgo: Tula, 6800 ft., 3 (U. S.). *C. t. planiceps:* México: Volcán de Toluca, 9000 ft., 2 (U. S.). *C. gymnurus:* Jalisco: Zapotlan, 4000 ft., 3 (U. S.). *C. varius:* Michoacan: vicinity of Uruapan, 5300 ft., 14; 1 mi. S Corupo, about 6500 ft., 2.

**Heteromys goldmani** Merriam.—Central American Spiny Pocket Mouse

*Specimens.—Chiapas:* Catarina, 1300 m, 15; Triunfo, 1950 m, 11.

**Liomys pictus isthmius** Merriam.—Painted Spiny Pocket Mouse

*Specimen.—Chiapas:* 10 mi. W Tuxtla Gutiérrez, 800 m, 1.

**Liomys irroratus torridus** Merriam.—Mexican Spiny Pocket Mouse

*Specimens.—Guerrero:* Chilpancingo, 1375 m, 19. *México:* Temascaltepec, 1600 m, 4. *Oaxaca:* Teotitlán, 950 m, 8. *Puebla:* Tehuacán, 1700 m, 25; Tepanco, 1800 m, 18.

The specimens do not form a uniform series, agreeing in all essential features with *torridus*, but instead variously represent intergradation of *torridus* with other geographic races. Those from Teotitlán are small, moderately dark and drab; the lateral line is indistinct and the cranium narrow and arched. In smallness they approach *minor*. Those from Chilpancingo are similar in color, but average larger and have a relatively smaller, more flattened brain case. The Tehuacán and Tepanco specimens are equally as large as those from Chilpancingo, but unlike those, and like topotypes of *alleni*, they are less dusky, more ochraceous, and have a broad ochraceous lateral line. The four examples from Temascaltepec are between *alleni* (from southern San Luis Potosí) and *torridus* (from Chilpancingo, not Teotitlán) in color, size, and cranial characters.

In addition to the above-mentioned specimens from centra Mexico, there are at hand 41 specimens from the lava areas south of Mexico City. These are not of the subspecies *alleni*, the race ascribed to the region by Goldman (1911) but rather constitute a heretofore unrecognized subspecies which may be known as

**Liomys irroratus pullus,** new subspecies.—Mexican Spiny Pocket Mouse

*Type.*—Adult male, skin and skull; University of Michigan Museum of Zoology no. 88735; México, Distrito Federal, Tlalpam, 2250 meters elevation, collected August 23, 1944, by Helmuth O. Wagner; original number 467.

*Distribution.*—Known from the pedregal and adjoining rocky areas in the southern part of the Valley of Mexico.

*Characters and comparisons.*—A large, dark pocket mouse similar to *Liomys guerrerensis* in coloration, but smaller than that species and having the smaller brain case, oval interparietal, narrow rostrum, long nasals, small teeth and other cranial characters of *Liomys irroratus*. Compared with *alleni* (specimens from southern San Luis Potosí) *pullus* averages larger; upper parts much darker and less ochraceous (the mass effect blackish in *pullus* and brown in *alleni*); lateral line less distinct and pale buff rather than ochraceous-buff; underparts cream rather than buffy; ascending branches of premaxillae accuminate posteriorly (truncate in *alleni*); upper incisors more procumbent; and the hard palate concave (convex in *alleni*). *L. i. pullus* is distinguishable from *torridus* (specimens from northern Oaxaca) by characters as follows: larger size (skull length in males averages 34.7 mm in *pullus*, 32.7 mm in *torridus* of comparable age and sex); darker upper parts with predominance of black and little of buffy hues; less distinct lateral line; broader white ear fringes; broader skull (well seen in size of brain case); accuminate rather than truncate endings of ascending branches of premaxillae; coterminous posterior borders of nasals and premaxillae (premaxillae extending posteriorly 1 mm or more beyond nasals in *torridus*); more procumbent upper incisors.

*Color.*—Upper parts grizzled black and Light Ochraceous-Buff, the black predominant over entire surface, but concentrated in a dorsal longitudinal stripe about 30 mm wide. Sides paler, grizzled black, gray (about Light Neutral Gray) and Pale Ochraceous-Buff. Underparts creamy white, meeting darker hues of sides abruptly to form a lateral line extending from nose to sides of hind legs; the line, however, is not bright Ochraceous-Buff as in some other subspecies of *L. irroratus*, but Pale Ochraceous Buff or Light Buff. Ears Fuscous, rimmed with white. Forelegs grizzled above to ankles, white below; forefeet white. Hind legs grizzled above, beoming black on undersurface of ankles and hind feet; remainder of hind legs and feet white. Tail Fuscous or Fuscous-Black above, white below.

*Measurements.*—Averages and extremes in millimeters of five male adults (each with transverse enamel folds almost obliterated in $M^1$, $M^2$, and $M^3$) from Tlalpam and San Gerónimo: total length, 256 (251–265); tail vertebrae, 134 (130–139); hind foot, 30.0 (28.0–31.5); greatest length of skull, 34.7 (34.3–35.1); zygomatic breadth, 16.3 (15.9–16.5); interorbital breadth, 8.5 (8.3–8.7); greatest length of nasals, 13.9 (13.3–14.3); breadth of brain case, measured on squamosals immediately anterior to auditory meatus, 15.1 (14.8–15.4); alveolar length of upper molar row, 5.5 (5.4–5.7). Females of comparable age average smaller. Averages and extremes of four females from Tlalpam: total length, 238 (229–250); tail, 128 (124–132); hind foot, 30 (29–31); length of skull, 33.9 (33.4–34.6); zygomatic breadth, 16.0 (15.4–16.8); interorbital breadth, 8.4 (8.2–8.6); length of nasals, 13.3 (13.0–13.6); breadth of brain case, 15.1 (15.0–15.4); length of molar row, 5.3 (5.0–5.5).

*Remarks.*—As now known, *L. i. pullus* is restricted in distribution to the pedregal and adjoining rocky areas in the southern end of the Valley of Mexico. An immature specimen from Rancho Córdoba is paler than specimens of comparable age from the pedregal; in this respect it grades toward *alleni*.

*Specimens examined.—Liomys irroratus pullus: Distrito Federal:* Contreras, 2600 m, 3; San Gerónimo, pedregal, 2400 m, 27; Tlalpam, 2250 m, 11. *México:* Rancho Córdoba, 2600 m, 1. *Liomys irroratus alleni: San Luis Potosí:* Río Verde, 5 (U. S.); Villar, 5 (U. S.).

**Liomys irroratus texensis** Merriam.—Mexican Spiny Pocket Mouse

*Specimens.—Nuevo León:* 20 km NW General Terán, 900 ft., 4. *Tamaulipas:* Acuña, 800 m, 1.

**Dipodomys phillipsii oaxacae,** new subspecies.—Mexican Kangaroo Rat

*Type.*—Adult male, skin and skull; University of Michigan Museum of Zoology no. 88652; México, Oaxaca, Teotitlán, 950 meters elevation; collected September 15, 1944, by Helmuth O. Wagner; original number 524.

*Distribution.*—Known only from the type locality, but probably ranges northward at low elevations in Puebla and adjoining states, and intergrades with the subspecies of the highlands—*phillipsii* and *perotensis*.

*Characters and comparisons.*—A subspecies of *Dipodomys phillipsii* characterized by small size, pale coloration, narrow black facial stripe, small ears, and moderately narrow skull with long interparietal, narrow interorbital space and small molariform teeth. *D. p. oaxacae* resembles *perotensis* more than it does *phillipsii*; in fact, cranial proportions of *oaxacae* and *perotensis* are essentially the same. It is distinguishable from *perotensis* by its smaller size (hind foot 36–37 mm, compared with 39–41 mm in *perotensis*); smaller ear (measured from notch in dry skin, about 10 mm and 12 mm, respectively, in the two races); paler, less blackish upper parts, the buffy hues Light Pinkish Cinnamon rather than Light Ochraceous-Buff; narrower black facial stripe (about as wide as rhinarium in *oaxacae* and twice that width in *perotensis*); more distinct black eye ring, made so by contrast with the paler surrounding areas; broader supraorbital white spot; smaller teeth (greatest width of $M^1$ less than 1.6 mm in *oaxacae*, greater than 1.6 mm in *perotensis*). Distinguishable from *phillipsii* by the same external characters which separate *oaxacae* from *perotensis* and, in addition, by narrower skull, well seen in the lesser spread of the maxillary arches, which average 55 percent (*oaxacae*) and 59 percent (*phillipsii*) of greatest skull length; narrower frontals (interorbital breadth averages 36 percent of skull length, compared with 40 percent in *phillipsii*); smaller interparietal; and smaller teeth (greatest breadth of $M^1$ greater than 1.6 mm in *phillipsii*).

*Color.*—Upper surface Light Pinkish Cinnamon, slightly overwashed with dusky and underlain with Plumbeous. Lower sides with less dusky and underlain with white. Cheeks white, lightly washed with dusky and Light Pinkish Cinnamon. Facial stripes, ring about eye, a spot on posterior inner surface of pinnae and a stripe on inner side of hind legs black. The following areas are white: area below black facial stripe, tip of nose, spot above eye, postauricular area, posterior part of pinnae, hip stripes, forefeet and forelegs, upper parts of hind feet and legs, lateral tail stripes, tip of tail and entire under surface of body. Soles of hind feet and ventral tail stripes Fuscous or black.

*Measurements.*—Type: total length, 255 mm; tail vertebrae, 160; hind foot, 37; ear from notch, dry skin, 10.5; greatest length of skull, 34.5; spread of maxillary arches, 19.6; length of nasals, 12.9; width of nasals near end, 3.2; width of maxillary arch at middle, 4.8; greatest length of interparietal, 3.2; greatest breadth of interparietal, 2.2; interorbital breadth, measured at posterior border of lacrymal, 12.5.

*Specimens examined.—Dipodomys phillipsii oaxacae:* Oaxaca: Teotitlán, 950 m, 4. *D. p. phillipsii:* Distrito Federal, Tlalpam, 10 (U. S.). *D. p. perotensis:* Vera Cruz: Perote, 4 (U. S.); Guadalupe Victoria, 8300 ft., 3 (Tex.). Puebla: Lago Salado, 8000 ft., 2 (Tex.); 10 km W Chalchicomula, 8300 ft., 1 (Tex.).

**Reithrodontomys megalotis saturatus** Allen and Chapman.—Western Harvest Mouse

*Specimens.—Distrito Federal:* Contreras, 2550–2600 m, 28; San Gerónimo, pedregal, 2400 m, 2. *México:* Rancho Córdoba, 2560–2600 m, 31; Río Frío, 2900–3000 m, 6. The species *megalotis* apparently is more abundant than either of the species *fulvescens* or *chrysopsis* in central Mexico. Of 87 specimens preserved by Wagner from Estado de México, 67 are *megalotis*, 19 *fulvescens* and 1 *chrysopsis*. Davis' collections (1944) netted similar proportions of the three species. Wagner collected both *megalotis* and *fulvescens* at three localities—San Gerónimo, Contreras, and Rancho Córdoba.

**Reithrodontomys fulvescens intermedius** Allen.—Fulvous Harvest Mouse

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 5; 20 km NW General Terán, 900 ft., 3. *Tamaulipas:* Acuña, 600 m, 1. Compared with specimens of *tenuis* from Mázatlan, Sinaloa,

these specimens appear more grayish in color, with less ochraceous hues on the back and sides. It is on the basis of these differences, which also are ones which differentiate *intermedius* from *tenuis* (Howell, 1914) that the specimens are identified with *intermedius*.

**Reithrodontomys fulvescens toltecus** Merriam.—Fulvous Harvest Mouse

*Specimens.—Distrito Federal:* Contreras, 2550–2600 m, 10; San Bartolomé, 2800 m, 1; San Gerónimo, pedregal, 2400 m, 4. *México:* Rancho Córdoba, 2650 m, 3. Compared with topotypes of *difficilis* and *helvolus* and with examples of *tenuis* from Mázatlan, Sinaloa, the above-listed specimens average larger in external measurements, size of brain case and size of bullae. They average darker dorsally and ventrally than the specimens of *tenuis* and *helvolus*, but are paler than the examples of *difficilis*.

**Reithrodontomys fulvescens helvolus** Merriam.—Fulvous Harvest Mouse

*Specimens.—Puebla:* Tehuacán, 1700 m, 4; Tepanco, 1800 m, 5. In his review of *Reithrodontomys fulvescens*, Howell (1914) referred a specimen from Tehuacán, the only one available to him from that area, to *R. f. difficilis*, a dark race with type locality at Orizaba, Vera Cruz. The nine specimens at hand from Tehuacán and Tepanco are pale, paler on the average than series from near the type localities of *difficilis*, *helvolus*, *tenuis*, and *toltecus*, the four subspecies reported from south-central Mexico. In common with the examples of *helvolus*, and not with the other specimens, they have large ears, white bellies and long, narrow incisive foramina. In sum of characters they are nearest *helvolus*.

**Reithrodontomys fulvescens chiapensis** Howell.—Fulvous Harvest Mouse

*Specimen.—Chiapas:* 1 mi. SE Comitán, 1500 m, 1. The specimen, an adult male in fresh pelage, was collected March 27 among short grass and oak scrub.

**Reithrodontomys fulvescens mustelinus** Howell.—Fulvous Harvest Mouse

*Specimens.—Guerrero:* Chilpancingo, 1360 m, 11. In size, breadth of brain case, and length of incisive foramina the specimens form two groups: (1) larger (greatest length of skull 22.9–23.4 mm), with large brain case (greatest breadth posterior to zygomata 11.0–11.1 mm) and short incisive foramina, which do not extend posteriorly to plane of molars; and (2) smaller (greatest length 21.8–22.7 mm) with small brain case (breadth 10.0–10.7 mm) and longer foramina, which extend to the molars. Because both sexes and young and old animals are represented in each group, the differences probably are not attributable to sex or age. As interpreted here they reflect interbreeding of two racial stocks in the vicinity of Chilpancingo, namely the smaller lowland-inhabiting *mustelinus* and the larger upland form, *toltecus*.

Howell (1914) mentioned that one of the principal characters distinguishing the subgenus *Reithrodontomys* from the subgenus *Aporodon*, namely absence of secondary cusps in the upper molars, is inconstant at some localities. It is inconstant in this series of *R. fulvescens* from Chilpancingo. Two specimens have well developed secondary cusps, two have none, and the remaining exhibit intermediacy between those extremes. In two specimens, well developed cusps are present on $M^2$ and $M^3$ but absent on $M^1$.

**Reithrodontomys chrysopsis chrysopsis** Merriam.—Volcano Harvest Mouse

*Specimen.—Distrito Federal:* San Mathens, 2800 m, 1.

**Reithrodontomys mexicanus mexicanus** Saussure.—Mexican Harvest Mouse

*Specimens.—Chiapas:* Finca Esperanza, 150 m, 1; Prusia, 1000–1100 m, 8. The specimen from Esperanza, a subadult male in worn pelage, was collected in a pineapple patch. It is duller and paler in color than examples of comparable age and pelage from Prusia and may represent a different geographic race. Additional specimens from the vicinity of Esperanza are needed for one to be certain.

**Baiomys taylori taylori** Thomas.—Pygmy Mouse

*Specimens.—Nuevo León:* 20 km NW General Terán, 900 ft., 2. One of the specimens has a streak about 2.0 by 4.0 mm on the hind part of the back wherein the hairs are entirely white. White streaking or flecking apparently is fairly frequent in *Baiomys taylori*. Of the 47 specimens of that species at hand, 6 are streaked with white in one or more places. None of the 15 specimens of *B. musculus* are so marked.

**Baiomys taylori analogus** Osgood.—Pygmy Mouse

*Specimens.—Distrito Federal:* San Gerónimo, pedregal, 2400 m, 36; Tepepan, 2250 m, 2. *México:* Rancho Córdoba, 2600 m, 7. Five of the specimens have white flecks in the pelage. The number per individual varies from one, in each of three females, to 22 in a male. The position varies with the specimen. The well-flecked male has three on the forehead, eight on the back, one on the rump, two on each side, and eight on the belly. The specimens from the pedregal near San Gerónimo are more blackish, with less of buffy hues, than those from Rancho Córdoba.

**Baiomys musculus musculus** Merriam.—Pygmy Mouse

*Specimens.—Guerrero:* Chilpancingo, 1360 m, 9. *Oaxaca:* Teotitlán, 950 m, 1. *Puebla:* Tehuacán, 1700 m, 3; Tepanco, 1800 m, 3. The specimens from Tehuacán and Tepanco are much paler and slightly larger than those from Chilpancingo, and probably represent a new geographic race.

**Baiomys musculus nigrescens** Osgood.—Pygmy Mouse

*Specimens.—Chiapas:* 11 km W Tuxtla Gutiérrez, 800 m, 4.

**Peromyscus maniculatus blandus** Osgood.—Deermouse

*Specimen.—Nuevo León:* 20 km N Galeana, 7000 ft., 1.

**Peromyscus maniculatus fulvus** Osgood.—Deermouse

*Specimens.—Distrito Federal:* La Cima, 2900 m, 10; Milpa Alta, 2400 m, 5. *México:* Rancho Córdoba, 2500–2600 m, 26; Río Frío, 3000 m, 1; Zempoala, 3200 m, 1. The specimens from these localities, which form an arc around the southern and eastern border of the Valley of Mexico, are distinctly paler and, on the average, smaller than those from the floor of the Valley nearer Mexico City. The Valley populations are referrable to *labecula*.

**Peromyscus maniculatus labecula** Elliot.—Deermouse

*Specimens.—Distrito Federal:* Contreras, 2550–2600 m, 38; San Bartolomé, 2800 m, 3; San Gerónimo, pedregal, 2400 m, 6; San Mathens, 2800 m, 1; Portillo de Santa Rosa, 3100 m, 3; Tlalpam, 2250 m, 3. Summer-taken specimens (August and September) are dark reddish brown in mass dorsally. That color contrasts markedly with the paler, grayer, and more buffy pelage of specimens collected later in the year (November and December). Summer specimens of *labecula* resemble summer specimens of *Peromyscus melanotis*.

**Peromyscus melanotis** Allen and Chapman.—Black-eared Mouse

*Specimens.—Distrito Federal:* Portillo de Santa Rosa, 3300 m, 8; San Mathens, 2800 m, 6; Santa Rosa, 2700 m, 9. In addition to the characters given by Osgood (1909) for distinguishing *P. melanotis* from similarly colored *P. maniculatus*, the color of the hairs at the anterior base of the ears has been found useful. In the specimens of *melanotis* examined, at least a few of the preauricular hairs are black, and usually there is a sufficient number to form a black tuft. In the specimens of *maniculatus* at hand from Mexico the preauricular hairs are the color of surrounding areas—gray or buffy, not black.

**Peromyscus leucopus texanus** Woodhouse.—White-footed Mouse

*Specimens.—Nuevo León:* 20 km NW General Terán, 900 ft., 7. *Tamaulipas:* Acuña, 800 m, 2.

**Peromyscus boylii levipes** Merriam.—Brush Mouse

*Specimens.—Chiapas:* Comitán, 1500 m, 2; Volcán de Tacaná, 3500 m, 2. *Distrito Federal:* La Cima, 2900 m, 1; San Bartolomé, 2800 m, 1; Santa Rosa, 2700 m, 1. *México:* Rancho Córdoba, 2560 m, 2. *Nuevo León:* 20 km N Galeana, 7000 ft., 1. *Tamaulipas:* Acuña, 800 m, 4. These specimens do not form a uniform series. Those from Nuevo León and Tamaulipas are brightest in color—bright tawny or ochraceous mixed with black. They have relatively narrower skulls and smaller brain cases than the other specimens. One specimen has a monocolored tail. Those from Distrito Federal and Estado de México are darker and grayer, less rufescent. They have comparatively large bullae and brain cases, approaching the size seen in *P. truei*. The Chiapas specimens also have the larger bullae and brain case of the specimens from central Mexico, but they are ochraceous, not grayish in color.

**Peromyscus oaxacensis** Merriam.—Oaxacan Mouse

*Specimens.—Chiapas:* Triunfo, 1950 m, 11. To separate some similar-sized skulls of *P. oaxacensis, P. mexicanus and P. allophylus* has proven to be difficult. In addition to length of hard palate, size of molar row, and other differential features pointed out by Osgood (1909), the shape of the molar row has proven useful for distinguishing *oaxacensis* from species of the *mexicanus* group. The rows are about parallel in *oaxacensis* while in species of the *mexicanus* group they are V-shaped, farther apart by about 5 millimeters anteriorly than posteriorly.

**Peromyscus truei gratus** Merriam.—Piñon Mouse

*Specimens.—Distrito Federal:* San Gerónimo, pedregal, 2400 m, 67. It is to be noted that all the specimens of *P. truei* collected by Wagner were taken on the pedregal. That large mass of igneous rock offers extensive habitat well suited to these rock-loving mice. Twenty-three of the 67 specimens are adults in full adult pelage. The remainder are juveniles in dark bluish gray pelage. All were collected in November.

**Peromyscus difficilis difficilis** Allen.—Big-eared Rock Mouse

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 9.

**Peromyscus difficilis felipensis** Merriam.—Big-eared Rock Mouse

*Specimens.—Distrito Federal:* Contreras, 2550 m, 1; San Bartolomé, 2900 m, 14. *México:* Río Frío, 3000 m, 3.

**Peromyscus melanophrys melanophrys** Coues.—Gray-cheeked Rock Mouse

*Specimens.—Distrito Federal:* Contreras, 2600 m, 1. *Guerrero:* Chilpancingo, 1360 m, 10. *Oaxaca:* Teotitlán, 950 m, 1. *Puebla:* Tehuacán, 1700 m, 1; Tepanco, 1800 m, 2. I find no constant differences between the Guerrero and Oaxaca-Puebla specimens. An old female from Tepanco is much larger than the other specimens of this individually variable species. It measures as follows: total length, 298; tail vertebrae, 165; hind foot, 26; ear from notch, 23; greatest length of skull, 32.9. The specimen from Distrito Federal, where the species heretofore was not known to occur, is a young female. It is smaller than specimens of comparable age from Guerrero, which fact may indicate that the populations of *P. melanophrys* from the vicinity of Mexico City are of the smaller-sized race *consobrinus*, not *P. m. melanophrys*.

**Peromyscus mekisturus** Merriam.—Long-tailed Rock Mouse

*Specimen.—Puebla:* Tehuacán, 1700 m, 1. This apparently is the second known specimen of the species. It is a male which measures as follows: total length, 222; tail vertebrae, 135;

hind foot, 22; ear from notch, 17. The pelage has been moderately abraded on the fore-back and sides making that area dull grayish and buffy in contrast to the brighter tawny head and remaining upper parts and the pale buffy underparts. In fresh pelage the specimen probably was tawny over most of the upper part of the body. The forefeet are white. The hind feet are dusky and white, the dusky predominant as a longitudinal dorsal stripe. The tail is clothed with short hairs and is unicolored.

E. A. Goldman and H. H. T. Jackson have kindly compared this with the type specimen. Dr. Jackson provides the following information regarding the two: "The main differences between the two specimens are that yours is a trifle smaller, is somewhat paler in color, lacks the distinct fulvous wash on under parts so pronounced in *mekisturus*, and has a higher brain case. The teeth and most other cranial parts seem to be identical."

**Peromyscus lophurus** Osgood.—Hairy-tailed Mouse

*Specimens.—Chiapas:* Triunfo, 1950 m, 6. Five of the specimens are adults as judged by their worn molariform teeth and adult pelage. One is in subadult pelage.

**Peromyscus guatemalensis guatemalensis** Merriam.—Guatemalan Mouse

*Specimen.—Chiapas:* Triunfo, 1950 m, 22.

**Peromyscus mexicanus mexicanus** Saussure.—Mexican Mouse

*Specimens.—Chiapas:* 10–11 km W Tuxtla Guitiérrez, 800 m, 3. The above-listed specimens are referred to the subspecies *mexicanus* on the basis of narrower skull (well seen in spread of zygomata and size of brain case) and paler, less blackish coloration, in comparison with specimens of *saxatilis* from southern Chiapas, El Salvador, and Hondurus.

**Peromyscus mexicanus saxatilis** Merriam.—Mexican Mouse

*Specimens.—Chiapas:* Catarina, 1300 m, 9; Prusia, 1100 m, 16; Triunfo, 1950 m, 1. That *saxatilis* is predominantly an inhabitant of lowlands is indicated in the series at hand from southern Chiapas. With increase in altitude the catch of *mexicanus* decreased. At the highest station, Triunfo, *guatemalensis*, *lophurus*, and *oaxacensis* were the common species.

In coloration the above-listed specimens resemble *Peromyscus guatemalensis* from the same areas in Chiapas. They are darker and more rufescent than specimens of other subspecies of *P. mexicanus* from El Salvador (*saxatilis*, *salvadorensis*, and *philombrius*) and larger and darker than examples of the race *mexicanus* from central Chiapas (Tuxtla Gutiérrez). That they are subspecifically distinct from those races is suggested by the material at hand. However, more complete and better prepared specimens are required to permit a clear appraisal of variation in *P. mexicanus* in southern Chiapas.

**Peromyscus allophylus** Osgood.—Mexican Mouse

*Specimens.—Chiapas:* Finca Esperanza, 150 m, 1; Cerro Ovando, 1775 m, 1. These specimens answer well the description of *allophylus* given by Osgood (1909), but they have not been compared directly with the type, the only known specimen of the species. They are of medium size (total length, 210–224; hind foot, 24–24). Tail short (100–108), essentially monocolored, finely scaled; sides dark brown deepening on back to form a median dorsal line of blackish brown; underparts yellowish white over slate; a black orbital ring and preorbital spot; feet whitish; ankles dusky; skull long and narrow (greatest length, 31.2–29.6, zygomatic breadth, 15.1–14.7); nasals short (12.6–11.4); tooth row short (4.3–4.2); bullae small, smaller than in *mexicanus*; supraorbital border not beaded. Compared with *P. gymnotis*, a closely related if not identical kind, known to me by two specimens from El Salvador, one of which was compared with the type of the species by Oldfield Thomas, my specimens show darker color, a more distinct dorsal stripe and a shorter tail, which characters may also distinguish *allophylus* from *gymnotis* (Osgood, *ibid.*).

**Oryzomys couesi couesi** Alston.—Mexican Rice Rat

*Specimens.—Chiapas:* Finca Esperanza, 250 m, 2; Prusia, 1100 m, 1. For subspecific determination of the rice rats of the species *Oryzomys couesi* I have relied largely on ranges of the subspecies as outlined by Goldman (1918).

**Oryzomys couesi aztecus** Merriam.—Mexican Rice Rat

*Specimens.—Oaxaca:* Teotitlán, 920–950 m, 4. *Puebla:* Tehuacán, 1700 m, 1; Tepanco, 1800 m, 4.

**Oryzomys couesi aquaticus** Allen.—Mexican Rice Rat

*Specimens.—Nuevo León*: 20 km NW General Terán, 900 ft., 5.

**Oryzomys alfaroi angusticeps** Merriam.—Central American Rice Rat

*Specimens.—Chiapas:* Catarina, 1300 m, 3; Triunfo, 1950 m, 4. The specimens, all adults with worn teeth, are referred to *angusticeps* largely because that race is known to inhabit the area (Goldman, 1918). I have seen no known specimens of *angusticeps*, *rhabdops*, or *hylocetes*, the forms ascribed to sou'hern Chiapas or areas contiguous thereto. When compared with Goldman's descriptions (*op.cit.*), the specimens as a lot to me agree best with *rhabdops* in coloration (Ochraceous-Tawny rather than Cinnamon-Brown as in *angusticeps*) and with *angusticeps* in spread of zygomatic arches, which are the principal characters differentiating the two races (Goldman, *ibid.*). Cranial dimensions of a specimen from Catarina, the smallest specimen in the graded series, are essentially the same as those given by Goldman for *O. hylocetes*, a form differentiated from *angusticeps* principally by cranial dimensions. This close agreement of diagnostic characters indicates that *hylocetes* should be treated as a subspecies of *O. alfaroi*, not as a separate species.

**Oryzomys fulvescens fulvescens** Saussure.—Fulvous Rice Rat

*Specimens.—Chiapas:* Prusia, 1100 m, 5. The specimens agree in measurements and description with the account of *fulvescens* given by Goldman (1918).

**Oryzomys fulvescens engraciae.**—Fulvous Rice Rat

*Specimen.—Nuevo León:* 20 km NW General Terán, 900 ft., 1. This specimen provides a second record of occurrence of the subspecies *engraciae* and apparently is the fourth known example of that race. The smallness and pallor considered diagnostic of the subspecies by Osgood (1945) are well shown in the present specimen, and there is fair agreement of measurements. Measurements of this specimen, a male with scarcely worn molars are: total length, 144; tail, 85; hind foot, 19; greatest length of skull, 20.4; zygomatic breadth, 10.6; interorbital constriction, 3.2; breadth of brain case (as measured by Goldman, 1918), 9.6; length of nasals, 7.4; greatest length of incisive foramina, 3.5; least length of hard palate, 3.3; alveolar length of molar row, 2.5.

**Rheomys thomasi chiapensis**, new subspecies.—Water Rat

*Type.*—Subadult male, skin and skull; University of Michigan Museum of Zoology no. 88320; México, Chiapas, Prusia, 1100 meters; collected March 14, 1942, by Helmuth O. Wagner; original number 31.

*Distribution.*—Known only from the type locality, but probably ranges southward in cloud and rain forests in the Sierra Madre.

*Characters and comparisons.*—A water mouse of the genus *Rheomys* closely related to *R. thomasi* Dickey of El Salvador and characterized by dark brown dorsal coloration, gray ventral coloration, broad brain case and zygomata, short anterior palatine foramina, which, nevertheless, extend posteriorly to plane of molars, and long maxillary tooth row. Similar to *R. t. stirtoni* in size, pelage length (underfur of mid-back, 6–7 mm), and color, but distin-

guishable cranially as follows: brain case larger (its posterior breadth amounts to 66 per cent of basilar length, compared with about 61 percent in *stirtoni*), zygomata broader posteriorly and narrower anteriorly (relative to skull length), anterior palatine foramina shorter (their length 32 percent of brain case breadth in *chiapensis* and 39 percent in *stirtoni*), and maxillary tooth row longer (22 percent of basilar length). Similar externally to *R. t. thomasi*, but probably larger, and separable cranially from that race by its much larger brain case (its breadth 66 percent of basilar length, compared with 60 percent in *thomasi*), greater spread of zygomata, and narrower rostrum.

*Measurements.*—Type specimen: total length, 208; tail vertebrae, 114; hind foot, 30; ear from notch, fresh skin, 9; greatest length of skull, 27.2; basilar length, 21.2; zygomatic breadth, 14.4; brain case breadth (greatest breadth posterior to zygomata), 14.0; interorbital constriction, 5.0; greatest length of nasals, 10.4; length of anterior palatine foramina, 4.5; length of hard palate, 5.4; alveolar length of maxillary tooth row, 4.7; greatest transverse diameter of $M^1$, 1.5.

*Remarks.*—The collecting of this specimen extends the known range of the genus *Rheomys* 250 miles to the north of Los Esemiles, El Salvador, the northernmost locality of occurrence as heretofore known (Dickey, 1928).

*Specimens examined.—Rheomys t. chiapensis:* Chiapas, Prusia, 1100 m, 1. *R. t. thomasi:* El Salvador, Dept. San Miguel, Mt. Cacoguatique, 14 (U. C.). *R. t. stirtoni:* El Salvador, Dept. Chalatenango, Los Esemiles, 3 (U. C.).

**Sigmodon hispidus mascotensis** Allen.—Hispid Cotton Rat

*Specimens.—Guerrero:* Chilpancingo, 1360 m, 1. *Oaxaca:* Teotitlán, 950 m, 2. *Puebla:* Tehuacán, 1700 m, 12; Tepanco, 1800 m, 1. The specimens from Oaxaca and Puebla are identified with *mascotensis* on the basis of large size (hind foot 30–33 mm), and long tail (maximum 147 mm). In these characters they resemble 12 specimens of *mascotensis* from Chilpancingo, which well represent the large, long-tailed group of *Sigmodon hispidus* (Bailey, 1902). In color, they are slightly paler than those specimens and much paler than specimens of *saturatus* from Department of Petén, Guatemala.

**Sigmodon hispidus saturatus** Bailey.—Hispid Cotton Rat

*Specimens.—Chiapas:* Prusia, 1100 m, 16. These specimens resemble *saturatus*, known to me by over one hundred examples from Department of Petén, Guatemala, in dorsal coloration, which is dark yellowish brown (mass effect about Sayal Brown). They differ from the Petén specimens, however, in having whitish (not rufescent) underparts, a more distinctly bicolor and longer tail (average and extremes, respectively, of 10 specimens 107 mm, 97–120 mm), shorter nasals, and more massive teeth (in 10 specimens the greatest transverse breadth of $M^1$ varies from 1.8 mm to 2.2 mm, averages 2.0 mm). Except for nasal length, these are the same characters by which *zanjonensis* is distinguishable from *saturatus* (Goodwin, 1932) which fact would seem to warrant application of the name *zanjonensis* to the series from Chiapas. However, those characters also serve to separate *tonalensis*, a race with type locality at Tonala, Chiapas, from *saturatus*. In the absence of known specimens of *zanjonensis* or *tonalensis* I have followed Bailey (1902) who included the cotton rats from southern Chiapas within the race *saturatus*.

**Sigmodon alticola amoles** Bailey.—Mountain Cotton Rat

*Specimen.—Mexico:* Rancho Córdoba, 2600 m, 1. The specimen, an adult male, has the well-haired tail, ochraceous underparts and nose, dull ochraceous upper parts, dark gray ears, small size (hind foot 26 mm) and short broad skull characteristic of *Sigmodon alticola amoles* (Bailey, 1902). Davis (1944) collected examples of this subspecies at Monte Río Frío, a locality about 20 kilometers southeast of Rancho Córdoba.

**Neotomodon alstoni alstoni** Merriam.—Volcano Mouse

*Specimens.—Distrito Federal:* San Bartolomé, 2800 m, 4; San Mathens, 2800 m, 5; Santa Rosa, 2700 m, 3; Portillo de Santa Rosa, 3300 m, 6. *México:* Río Frío, 3000 m, 15. As has been pointed out by Davis and Follansbee (1945) individual variation in the species *N. alstoni* is sufficient to obscure most geographic variation. In the series they studied, representing six localities in central Mexico, they observed palest coloration in specimens from the Cofre de Perote-Orizaba region (*N. a. perotensis*) and darkest coloration in the specimens from Laguna Zempoala (*N. a. alstoni*). In the series now before me the specimens from the southwestern end of the Valley of Mexico, 15 or 20 miles airline north of Zempoala, are darker than those from Río Frío, a locality about 35 miles southeast of Mexico City. Some of the difference in color probably is attributable to dissimilar pelages, for the Río Frío specimens (collected in January) have longer, less abraded fur than those from the other localities (taken in the period August–November). There is evidence to show that the southwestern and southeastern populations, however, may be distinct at all seasons of the year. One molting specimen from San Mathens, collected in October, has acquired fresh pelage over about half of the body. That pelage is darker than comparable pelage in the Río Frío material. Furthermore, the juvenile pelages in the two series are in stronger contrast than the adult pelages; and the two series differ in at least one cranial detail—the length of the incisive foramina. Specimens from Río Frío have shorter incisive foramina than those from the other localities. This difference is slight (0.1–0.7 mm less) but constant, if the specimens are closely matched in age and sex. The paler color and shorter foramina of the Río Frío material is here interpreted as gradations toward the paler *perotensis*.

**Neotoma torquata** Ward.—Plateau Wood Rat

*Specimens.—Puebla:* Tehuacán, 1700 m, 5. The occurrence of *Neotoma torquata* at Tehuacán extends the known range of the race about 40 miles to the south of Chalchicomula, Puebla, the southernmost limit as previously known (Goldman, 1910).

**Hodomys vetulus vetulus** Merriam.—Fulvous Wood Rat

*Specimen.—Oaxaca:* Teotitlán, 950 m, 1.

**Microtus mexicanus mexicanus** Saussure.—Mexican Vole

*Specimens.—Distrito Federal:* Contreras, 2550–2600 m, 7; La Cima, 2900 m, 7; Portillo de Santa Rosa, 3300 m, 1; San Bartolomé, 2900 m, 9; San Mathens, 2800 m, 4; Xochimilco, 2400 m, 4. *México:* Río Frío, 3000 m, 1.

**Microtus mexicanus subsimus** Goldman.—Mexican Vole

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 5. The specimens from Nuevo León average slightly larger than specimens of *mexicanus* from central Mexico, the molar row is shorter, nasals shorter and more abruptly constricted posteriorly, bullae more rounded and fully inflated (less definitely discoidal in shape) and the interorbital diameter smaller. Most of these differential characters were pointed out by Goldman (1938) in his description of *subsimus*.

**Sylvilagus floridanus chapmani** Allen.—Florida Cottontail

*Specimens.—Nuevo León:* 20 km N Galeana, 7000 ft., 1; 20 km NW General Terán, 900 ft., 1.

**Sylvilagus floridanus orizabae** Merriam.—Florida Cottontail

*Specimens.—México:* Ixtaccihuatl, 2500 m, 1; Lerma, 2600 m, 1; Rancho Córdoba, 2500–2600 m, 2.

general color not very unlike some specimens of *texianus*, but the ears are edged with white and the other characters are as in the rest of the Colorado series.

*Skull.*—Similar to those of *berlandieri* and *texianus*, but smaller, more smoothly rounded, less angular and massive than in either; frontal profile slightly more depressed, the supraorbital ridges less upturned and less prominent; dentition about the same.

*Measurements.—Type:* Total length, 271 mm; tail vertebrae, 113; hind foot, 34. Averages and extremes of five adult male topotypes. Total length, 247 (230-254); tail vertebrae, 91 (81-98), hind foot, 31.5 (31-32.5). Three adult female topotypes, respectively. Total length, 224, 237, 230; tail vertebrae, 87, 92, 86; hind foot, 32, 31, 30. Skull (type): Greatest length, 35.7; condylobasal length, 33.7; zygomatic breadth, 20.7; interorbital breadth, 5.2; length of nasals, 13.4; width of brain-case (over mastoids), 14.2; width of rostrum (maxillae at antorbital notch), 5.9; interparietal (at median line), 3.3; maxillary toothrow (alveoli), 6.3.

*Remarks.*—Some reports have indicated that the range of *Sigmodon hispidus texianus* has been extended northward by invasion of formerly unoccupied localities in parts of Kansas, from which it might be expected to follow stream valleys into southeastern Colorado. The characters presented by the new form *alfredi*, however, are such as might be expected in the development of a long established regional race.

*Specimens examined.*—Total number, 13, all from Baca Co., Colorado, as follows: I. N. Pruitt Farm near Williams' Corner, 11 miles north of Springfield, 9; Fred Gold Farm, 6 miles west of Williams' Corner, 4.

**Sigmodon ochrognathus madrensis, subsp. nov.**

*Type.*—Male adult, skin and skull; no. 96268, U. S. National Museum (Biological Surveys collection); collected in the foothills of Sierra Madre, about 30 miles northwest of Parral, altitude 6,200 feet, southern Chihuahua, Mexico, by E. W. Nelson and E. A. Goldman, September 22, 1898; original number, 13051.

*Distribution.*—Known only from the type locality in the eastern foothills of the Sierra Madre, southern Chihuahua, but may have an extensive range in the neighboring mountains of the Sierra Madre Occidental Biotic Province; Upper Austral Life Zone.

*General characters.*—A subspecies with muzzle and narrow orbital areas deep "ochraceous-tawny". Similar to *Sigmodon ochrognathus ochrognathus* of the Big Bend region of the Rio Grande in Texas and Coahuila, but upper parts more suffused with buff; skull more elongated and relatively narrower. Differs from *Sigmodon ochrognathus montanus* of southeastern Arizona in darker, more buffy, less grayish general coloration, and deeper "ochraceous-tawny" muzzle.

*Color.—Type:* Upper parts in general a mixture of "pinkish buff" and black-tipped hairs, the "pinkish buff" most evident on rump and lower part of sides; under parts and inner sides of limbs whitish, suffused with pale buff, the hairs whitish to roots on chin and throat; ears dusky, overlapped anteriorly by buffy hairs; muzzle and narrow orbital rings deep "ochraceous tawny"; feet dull whitish; tail blackish above, dull whitish below to near tip, which is blackish all around. A young specimen in first pelage is more distintctly suffused with "ochraceous tawny" than in typical *ochrognathus* of corresponding age.

*Skull.*—Similar to those of *ochrognathus* and *montanus* but more elongated and relatively narrower than either; zygomata narrower posteriorly, less converging anteriorly, the sides more nearly parallel; rostrum more elongated, less depressed anteriorly; braincase more highly arched; dentition similar.

*Measurements.—Type:* Total length, 258 mm; tail vertebrae, 113; hind foot, 29. Skull (type): Greatest length, 33.2; condylobasal length, 32.5; zygomatic breadth, 18.8; interorbital breadth, 5.3; length of nasals, 12.3; width of braincase (over mastoids), 13.3; width of rostrum (maxillae at antorbital notch), 4.3; interparietal (at median line), 2.3; maxillary toothrow (alveoli), 6.2.

*Remarks.*—The genus Sigmodon is represented by several living species quite distinct from typical *Sigmodon hispidus*. The latter subdivides into numerous geographic races, but

presents remarkably uniform general characters throughout its great range from the southern United States to northern South America. Most of the other species are imperfectly known and their apparently restricted ranges, mainly in the mountains in Mexico, suggest that they are relict forms, or offshoots of the genus which formerly had a wider distribution. The known ranges of some are undoubtedly incomplete, but others may be on the verge of extinction. *Sigmodon ochrognathus madrensis* requires no close comparison with *Sigmodon leucotis*, a geographic neighbor inhabiting similar territory to the southward in the Sierra Madre of Durango and Zacatecas. The latter is characterized externally by details of color, the ears clothed with short grayish hairs, the tail nearly unicolor, dusky all around, and the muzzle lacks the "ochraceous tawny" of *madrensis*. The skull in *leucotis* differs notably from that of *madrensis* in short, posteriorly truncate braincase, short, anteriorly depressed rostrum and much larger auditory bullae.

*Specimens examined.*—Two, from the type locality.

*Fish and Wildlife Service, Washington, D. C.*

---

## GENERAL NOTES

### MIGRATION OR HIBERNATION OF TADARIDA MEXICANA

The matter of whether the Mexican free-tailed bat hibernates or migrates has long been in controversy. Literature has it hibernating but observation indicates that it migrates. The controversy began with Vernon Bailey (1928). In his "Animal Life of the Carlsbad Caverns" he states:

"The number of bats in the cave varies at different seasons, apparently reaching the maximum in August and September, when they gather for their winter sleep . . . On my arrival at the cave, March 11, they were quiet, and most of them apparently were still in the torpor of hibernation. A few days later, on warm evenings, they began to come out of the west entrance in considerable numbers and disappeared into the darkness of the night. At first about one thousand were estimated as leaving the cave during the twilight hour, but later the numbers increased until on May 5 about twelve thousand . . . came out in one hour . . . Each morning they returned and entered the cave apparently in considerably less numbers than those leaving the night before . . . All evidence points to the fact that the Carlsbad Caverns is mainly a wintering place for these bats, where they pass the winter in a state of torpor."

Similarly in the National Geographic Magazine Bailey (1925) states: "Their numbers vary at different seasons, apparently reaching the maximum in late summer and early fall, when they gather for the winter's sleep, and the minimum about the first of May, when many have left for lower country and better feeding ground."

The National Park Service has engaged in no active research at Carlsbad Caverns. Mammalogists generally have overlooked the Mexican free-tailed bat and so writers of necessity have been forced to rely on the meager observations of Vernon Bailey for their information on the life and habits of this bat species. Thus most writers have erroneously credited the Mexican free-tailed bat with life habits of the family Vespertilionidae or have vaguely quoted Bailey. Allen (1940), for example, in his recent book quotes: "Vernon Bailey, writing of the 'guano bat' of the southwestern United States, says that great numbers resort to the Carlsbad Caverns to winter."

He indicates the opposite, however, later: "Writing of this species (*Eumops californicus*) and the Mexican free-tail in California, Mrs. H. W. Grinnell has found both active at various times in winter, with no sign of hibernation. Instead, however, she adduces evidence that they seek more sheltered situations at this season and thus may be absent from places occupied in summer."

All National Park Service publications follow Bailey's lead and have the Mexican free-

tailed bat hibernating. Thus the summary in nearly all such publications states that "From October until April they hibernate . . . seeming almost lifeless."

General surprise at the suggestion that Bailey was in error, that the Mexican free-tailed bat is migratory, has prompted the writer to investigate this question rather thoroughly. Every available source of information has been examined. All evidence favors migration and none supports Bailey's claim of hibernation.

Strangely, even casual observation fails to support the notions of hibernation. True, the heaviest bat flights normally occur in late summer and early fall—the season with most insects—but the colony of bats at Carlsbad Caverns decreases greatly in early November, is normally completely absent in mid-winter, reappears in mid-March and increases sporadically during the summer months to reach the late summer maximum.

This mid-winter disappearance of the bat colony is not a recent phenomenon. L. W. Jerome, Superintendent of the guano mining operations at Carlsbad Caverns, has indicated to the writer that the bat colony was regularly absent from the Bat Cave during the mid-winter months. As at present, a very small colony of bats usually persisted through early winter but seldom did they stay for the entire winter.

Former members of the Park Service personnel have orally supported this contention. In fact not one observer has ever seen any really large number of bats in the Bat Cave between the months of November and March; all agree that the Bat Cave is relatively devoid of bats in mid-winter.

The writer began a series of recorded observations in the summer of 1942 to determine the habits of the colony at roost. The place of roosting shifted slowly from the normal summer roost to the winter roost as fall approached making any estimate of the number of individuals difficult. A decrease in numbers became evident by mid-October and continued sporadically until only a very small number remained in February. At no time were the bats in a state of torpor.

Subsequent similar observations concur. The bat colony diminishes and disappears as winter approaches. The bats do not hibernate. Examination of bat stomachs indicates that they feed throughout the winter although their fall accumulation of fat is probably a guarantee against periods when feeding is impossible. In fact several observations indicate that in periods of adversity the Mexican free-tailed bat, by curtailing normal activity, can conserve energy and survive for a considerable period of time.

Fall migration of this bat seems to be induced by the diminishing food supply far more than by the temperatures. The bat is very hardy, however, and can survive surprisingly low temperatures. The bat follows his food supply; thus, as a portion of the bat colony shifts location in search of food, the number of residents in the Bat Cave at Carlsbad Caverns National Park fluctuates constantly. It reaches the maximum of millions in early fall when the insect food supply is plentiful and becomes nonexistent in mid-winter when no food is available.

LITERATURE CITED

ALLEN, GLOVER M. 1940. Bats. Harvard University Press, Cambridge, p. 272.
BAILEY, VERNON. 1925. Bats of the Carlsbad Cavern. Nat. Geog. Mag., pp. 323-324.
———. 1928. Animal Life of the Carlsbad Cavern. Williams and Wilkins, Baltimore. P p. 108–111.

ERNST CHRISTENSEN, *Carlsbad Caverns National Park, Carlsbad, New Mexico.*

NOTES ON KEEPING BATS IN CAPTIVITY

Keeping insectivorous bats in captivity has presented a considerable problem to those who have attempted it because of the burdensome task of supplying insects in the relatively large numbers consumed daily by these animals, and the difficulty of administering this food under captive conditions. Allen's valuable book ("Bats" Cambridge: Harvard

University Press, 1940) contains many references to this subject, and it is to be noted that few people have been successful in keeping bats alive for long periods.

Artificial diets have appealed to most workers as the solution. Gates (Jour. Mamm., vol. 17, p. 268, 1936; vol. 19, p. 461, 1938.) has successfully kept several kinds of bats on a standard mixture of cream cheese, egg yolk, and bread crumbs, varied from time to time with other foods. Having had no success in persuading my bats to eat these foods, or to remain healthy on them when they did eat them, I have settled upon a method which has the advantage of providing a food readily accepted by the bats and which approximates a natural diet, but still overcomes the problems usually posed by an insect fare.

The food used is the pupae of greenbottle flies, which can easily be reared in enormous quantities. There are several standard methods for rearing these flies and the method adopted will depend upon individual facilities. Under conditions here the simplest system has been not to carry the flies through the complete life cycle in cages, but rather to place the larval food (dead rats or any sort of readily available meat) out where it will become fly-blown and then to put the dish containing the feeding larvae into or over a large container of sand, making sure that sufficient food is supplied to permit growth of the larvae to full size. When fully fed, the larvae crawl out into the sand to pupate and may be easily picked up in a strainer. Once they are removed from the sand the pupae may be separated from the still active larvae by pouring them out onto something flat from which the larvae readily crawl back into the sand leaving behind the pupae which are then poured into a dish from which the bats eat them. I have found it advisable to remove the larval food promptly when most of the greenbottle larvae have left it and put in a freshly infested supply, since the larvae which leave the meat last are mostly those of a sarcophagid fly which the bats will not eat. The bats will take the calliphorids readily as larvae, pupae, or adults and will discriminate at all these stages between them and the sarcophagids, leaving the latter behind in the dish.

The kinds of bats so far tried which have taken readily to a diet of pupae are *Myotis yumanensis*, *Myotis ihysanodes*, *Myotis sodalis*, and *Eptesicus fuscus*. A *Myotis californicus* has also been kept successfully, but on a diet of termites, since it refused to eat the flies. Termites have the dual disadvantage that they cannot be cultured rapidly enough to feed the bats and must be chloroformed or killed to keep them from crawling away before the bats have a chance to eat them. The *Myotis* are kept in a wire cage 3 feet long, 2 feet wide, and 16 inches high. This size allows them to fly about, which they do at night while feeding. They are fed in flat dishes placed on the floor of the cage, and water is also supplied at all times in similar dishes. As nearly as has been determined so far, these *Myotis* eat on the average about one-half their own weight in pupae (or termites) each night. The amount taken varies from night to night. They often eat very little for several nights and then a great deal for the next few nights. The *Eptesicus* is kept in a small cage in which it cannot fly, and eats about one-third its weight in food per day. For those kinds of bats, such as *Myotis californicus* or *Eptesicus fuscus*, that are not adept at running about on the ground another type of feeding dish is more satisfactory than a flat one. This is a bird feeding dish open at the top and placed on the side of the cage so that the bats can hang on the side of the cage above the dish and feed in this vertical position.

One *Myotis yumanensis* has now been alive and apparently healthy for 10 months and the *Eptesicus* for 8 months. During the early part of their captivity the fly-raising technique had not been perfected and the bats often had to go hungry for considerable periods. Avoidance of starvation was accomplished by literally "putting them on ice." On several occasions the *Myotis* was kept without food at a temperature of about 50° F. for as long as three weeks. The *Eptesicus* was in a semi-dormant state when collected on December 1, and was placed between sheets of cardboard in a wooden box in a very moist atmosphere at a temperature of 36.5° F. It was left here until January 26, during which time its weight dropped from 20 to 18 grams. After being kept out for a day and fed, so that it again weighed 20 grams, it was put back into the cold room and left until February 15, when it again weighed 18 grams. The process was repeated once more, and between February

16 and March 30 its weight dropped from 19 to 16.5 grams. Since March 30 it has been kept at room temperature and its weight at present (August 1) is 30 grams. Six *Tadarida mexicana* placed in the cold room under identical conditions during the same period were all dead within a month.

The different species and individuals vary considerably in their ability to recognize pupae as food. Some eat pupae without teaching; others will learn after being fed by hand; others never seem to learn. With care, however, and with a variety of insect foods in large quantities, it is likely that many species can be successfully kept under laboratory conditions. The species also react differently to enforced dormancy. Although data on this subject are few, the optimum conditions for maintaining the bats alive while dormant are apparently temperatures not far above freezing plus a high degree of humidity.—MARY C. RAMAGE, *Museum of Vertebrate Zoology, Berkeley, California.*

### A BAT WITH WHITE WING TIPS

On October 4, 1931, the writer visited Good's Cave in Thompson Township, Seneca County, Ohio, and collected two female Georgian bats, *Pipistrellus subflavus obscurus*. One of these was of abnormal coloration in that the tips of the wings were white. Specimens obtained later from this cave, seven on November 1, 1931, and seven on February 13, 1932, were all of normal coloration. All of these specimens were identified by Dr. Remington Kellogg. The abnormal colored specimen is no. 1042 in the Ohio State Museum.

A photograph of this specimen was sent to the late Dr. G. M. Allen, who wrote to me concerning it: "Albino bats are relatively rare, but occasionally one finds a specimen with white wing markings. I had never seen one before in the species you sent. However in one of the tropical South American species, *Artibeus*, it is not unusual to find exactly the same white wing tips, and very likely such a character once established would become a permanent part of the pattern in the species. Perhaps, too, in this way arose some of the white-winged kinds".—ROBERT GOSLIN, *316 Wilson Ave., Columbus 5, Ohio.*

### ALBINO PRAIRIE-DOG

The following is quoted from a correspondent, Mr. F. C. Nichols, P.O. Box 328, Trinidad, Colorado. "One of the writers friends . . came across a burrow containing pure white prairie dogs [*Cynomys ludovicianus*] and was successful in catching one of the litter alive and has it here now at his home. It is a very young one, absolutely pure white with perfect pink eyes. . .".—G. H. H. TATE, *American Museum of Natural History, New York, N. Y.*

### ON TAIL COLOR IN NAPAEOZAPUS

Whether the white tail pigmentation of the *Napaeozapus insignis* is a sex character or not has been a debated subject. C. H. D. Clarke (Canadian Field Nat., vol. 49, p. 139, 1935) stated that he observed a sex linked character in this pigmentation: the males displaying more pigmentation than the females. However, Norman Preble in his paper (Jour. Mamm., vol. 19, p. 254, 1938) stated that with New England *Napaeozapus*, this character did not hold. In New England specimens, the area of the white pigmentation is tremendously variable (0–42) mm, with females averaging 2 mm more than the males. Using the collection of the Cleveland Museum of Natural History, I averaged the pigmentation of 55 adult *Napaeozapus*. These skins are mostly from Ohio, with a few skins from New York and New Hampshire. The white pigmentation was measured from its first appearance on the dorsal surface of the tail to the fleshy portion at the tip, not including the pencil. Thirty eight males averaged 13.71 mm (0–41.5); seventeen females averaged 12.29 mm (0–27). One can readily see that the length of the area of pigmentation overlaps in both sexes to such a degree as to make it useless as a sex character. It is regrettable that I did not have access to more material of this genus, but I think that the figures are true enough to corroborate Preble's statement.

In the course of this work, I noticed there was considerably less white on the tails of Ohio specimens than on the tails of New York and New Hampshire skins.—C. ARTHUR FOSTER, *17873 Lake Rd., Lakewood 7, Ohio.*

### ALBINO COYOTES ARE RARE

True albino coyotes (*Canis latrans*), which have pink eyes and pink pads on their feet, are very rare, as indicated in a recent examination of the records in the Division of Predator and Rodent Control of the U. S. Fish and Wildlife Service. From July 1, 1915, to June 30, 1945, the hunters of this Service and its cooperators have taken 1,672,604 coyotes, of which 6 were true albinos. These albinos were taken in California, Idaho, New Mexico, Oregon, and Wyoming. This record is one per 278,767 coyotes captured.

On November 10, 1945, Frank J. Stocke, employed as a predatory animal hunter by Dunn County, North Dakota, in cooperation with the U. S. Fish and Wildlife Service and the North Dakota State Department of Agriculture, took a true albino coyote seven miles north of Killdeer. The skin and skull of the animal are now no. 274759 in the U. S. National Museum.

Since taking this coyote in Dunn County, a report has been received that another albino was captured in the same general locality by Ralph and Bud Fisher on their ranch.—D. D. Green, *U. S. Fish and Wildlife Service, Chicago 54, Illinois.*

### BOBCAT PREYS ON DEER

On March 9, 1946, in checking the mule deer range near the west side of the Ruby Lake National Wildlife Refuge, Nevada, I found a rather unusual record of a doe (*Odocoileus hemionus*) being killed by a bobcat (*Lynx rufus*). We were working through a bed ground at about 6,000 feet elevation in scattered clumps of juniper, service berry, bitter brush and heavy sage brush on a southern and eastern exposure where the sun had melted most of the snow leaving soft mud underfoot. From the tracks in the mud it was apparent that the bobcat had sneaked up on the deer, jumped her, grabbed her by the throat and brought her down just 14 feet from the bed. The bobcat ate one meal from a ham and neatly covered the place he had eaten from and the wound on the neck with grass and twigs. The doe had been dead about 12 hours when found and from all appearances was normal and in good condition when killed. She was estimated to weigh about 100 pounds.

There were no other tracks near the kill, and since the ground was muddy at the time, it was not difficult to check the tracks and piece together the details of the attack. The bobcat (a male estimated to be about 3 years old and weighing 25 pounds) was caught the next day in a trap which had been set by the deer's carcass.—Herbert H. Dill, *Fish and Wildlife Service, Ruby Lake National Wildlife Refuge, Ruby Valley, Nevada.*

### COTTONTAIL BREEDING IN ITS FIRST SUMMER

On August 1, 1945, my colleague, Dr. Paul L. Errington, brought me the skeleton and gravid uterus of a Mearns cottontail (*Sylvilagus floridanus mearnsii* Allen) obviously of the 1945 crop. It was taken July 29, 1945, as a pest at the Stanton Avenue community gardens, Ames, Iowa. The cottontail weighed 600 gr., had a total length of 344 mm. and a hind foot length of 87 mm., according to Dr. Errington. The skull of this young female is about nine-tenths as long as that of a female cottontail known to be more than a year old, and the cranial sutures of the young skull are very distinct. Epiphyseal cartilage is clearly evident at the joint regions of the appendicular skeleton. Two of the six fetuses, in permanent mounts, show pigmented optic vesicles and other characters indicating two weeks of development. March 1945, the third warmest March in 73 years of recorded Iowa weather history, was highly favorable to early vegetative growth and cottontail production. Possibly this young female cottontail was about 5 months of age when taken.—George O. Hendrickson, *Iowa Cooperative Wildlife Research Unit, Iowa State College, Ames, Iowa.*

### NOTES ON BEHAVIOR OF COYOTES

In the course of a month's trip (June 1946) to Yellowstone National Park where we had been continuing a study of coyote (*Canis latrans*) migration by means of ear-tagging, the authors made several observations of coyote behavior that seem worthy of record.

Predation on game animals, particularly the young, is a common occurrence, and with the present over-population of big game in the Park, this may be advantageous in holding the herds in check. Antelope (*Antilocapra americana*) and deer (*Odocoileus hemionus*) frequently were observed chasing coyotes; this appeared to be a "game" with both until the coyotes, apparently tiring of the play, began dodging and snapping at the larger animals. Of particular interest was the spectacle of a doe antelope rushing to chase a coyote; the coyote, however, had other ideas and ran to meet the antelope. The latter barely reversed its direction in time, and there followed a wild half-mile chase with the coyote, only a few feet behind at the beginning, gradually losing distance and finally quitting.

The coyotes appeared to expect harassing by the game animals, and apparently made no effort to avoid it. Typical of the coyotes' confidence in their ability to escape the charges of the larger animals was the action of two coyotes in evading a doe deer. One afternoon Robinson observed a coyote crossing a small meadow in the direction of some timber. When about 50 yards away, the coyote paused and waited while a deer emerged from the trees. A chase ensued with the coyote running in small circles, gradually edging toward the timber, and finally entering with the deer in close pursuit. Suspecting a den in the direction the coyote was traveling, Robinson rode into the timber, encountered the deer, and frightened it from that immediate locality. Some 15 minutes later, however, a second coyote was observed crossing the meadow in the same direction and place. It approached the timber, paused, and was challenged by the same deer. Again, by running in small circles, the coyote was able to elude its pursuer and gain the protection of the timber. Apparently both coyotes knew that a deer was waiting at the timber's edge, and could have avoided a chase merely by entering at a different point.

That all coyotes are not so successful in evading the charges of game animals was indicated by the finding in September 1945 of a coyote that had been stomped to death. This animal, however, had been trapped and tagged three weeks earlier, and it is possible that an injured front foot had reduced its speed.

Numerous stories have been told of coyotes and badgers (*Taxidea taxus*) fighting, particularly when trapped at the same spot, and thus the sight of these two predators hunting peaceably together was rather unexpected. This was observed twice in one day—the first time with field glasses at a distance of about a mile and a half. A coyote and a badger were watched for about 30 minutes while they hunted together; the coyote took the lead and frequently waited for the badger to catch up, much as it would be expected to act toward its young. Finally, the coyote laid down while the badger hunted nearby; after a few minutes' rest, and apparently tiring of its companion, the coyote leaped to its feet and ran quickly away, leaving the smaller animal hopelessly behind. That this coyote was more sociably inclined than others of its kind seems contradicted by the fact that it was the same animal that gave the antelope such a vicious chase a few minutes later.

Several hours afterward while driving along a highway, we frightened a coyote and a badger from behind a large rock at the edge of the road. The two animals ran together for about 50 yards, than paused a few feet apart to watch the car go by.

Adult coyotes have been known to swim streams, even the more rapid ones, but appear to do so rather reluctantly. Therefore, the sight of a coyote pup voluntarily swimming seemed unusual. We had located a den near a small pond, perhaps 15 yards in width. Upon removing five pups, and tagging and ear-docking each one in turn (the ears were docked to permit recovery within the Park only of ear-tagged coyotes), the young animals were turned loose. They were approximately five weeks old and just able to walk well. Four went around the pond, but the second one to be released headed straight for the water, ran clumsily through the tall vegetation at its edge, swam expertly to the other side, emerged without shaking itself, and continued hurriedly over a hill and out of sight!

Coyotes in the Park are noted to travel in packs during the winter, and this trait of sociableness also was evident at denning time. Occasionally several adult coyotes, in place of the customary two, were encountered at dens. The theory that these packs were composed of parents and their young of previous years seems substantiated by the fact that

two, and possibly three, tagged coyotes, recognized by the cropped right ears, were observed at a den together with two denning coyotes. A litter of three pups had been tagged in that vicinity a year previous, and the adult, crop-eared coyotes obviously were the pups of last season still with their parents a year later.—WELDON B. ROBINSON AND MAYNARD W. CUMMINGS, *Wildlife Research Laboratory, U. S. Fish and Wildlife Service, Denver, Colorado.*

### MAMMALS FOUND IN A CISTERN IN THE CABEZA PRIETA MOUNTAINS, ARIZONA

On April 10, 1946, while patrolling the Cabeza Prieta Game Range in Yuma County, Arizona, with John A. Kempton, we investigated the contents of a dry cistern. This concrete reservoir located in the Cabeza Prieta Mountains was 6 feet deep, 3½ feet wide, and 10 feet long. It was so placed in a side drainage that water from a small arroyo could drain into it through a screen. This structure was raised one foot above ground level and roofed with wood. In one corner was a manhole, the cover of which had been broken.

A number of small mammals had, at one time or another, gone into the cistern and had been unable to leave. The bottom was covered with about one-half inch of accumulated debris and in this we found the remains of eight kinds of mammals. These were sent to Dr. William B. Davis, Head of the Department of Fish and Game, Agricultural and Mechanical College of Texas, who kindly identified them. The subspecific names, where used, are based upon geographical probability.

1 skeleton, *Antrozous pallidus pallidus*
1 skull, *Bassariscus astutus* (*yumanensis*?)
4 skulls, *Urocyon c. scotti*
1 skull, *Citellus tereticaudus neglectus*
1 skull, *Perognathus baileyi domensis*
1 skull, *Perognathus* (cf. *longimembris*)
2 skulls, *Dipodomys merriami regillus*
1 skull, *Neotoma* (cf. *albigula*)

It was surprising to find the remains of *Perognathus* and *Dipodomys*. Whether they fell in or were seeking water is a moot question.

If upon comparison the *Bassariscus* proves to be *yumanensis* it will shed light on the range of this form, which was described by Huey (1937) from the Gila Mountains 10 miles to the west across the Lechuguilla Desert. The lack of remains of *Vulpes macrotis*, which occurs in this general area, although less commonly than *Urocyon*, substantiates field records that *Vulpes* is more or less confined to desert plains while *Urocyon* is more often found on rockier, slightly higher ground.—ARTHUR F. HALLORAN, *Fish and Wildlife Service, Yuma, Arizona.*

### A RECORD OF EUTAMIAS AMOENUS FROM SNOW MOUNTAIN, CALIFORNIA

In northwestern California, chipmunks of the species *Eutamias amoenus* occur only on the higher crests of the inner Coast Ranges, and their geographic range is thus broken into small, isolated segments. The southernmost population previously recorded in this general area is that of the Yolla Bolly Range in Trinity, Tehama, Mendocino, and Glenn counties (Howell, N. Amer. Fauna, no. 52, p. 63, 1929; Johnson, Univ. California Publ. Zool., vol. 48, no. 2, p. 85, 1943). That there is a still more southern population is shown by a specimen from Snow Mountain, northwestern Colusa County, in the Natural History Museum of Stanford University. The specimen is a study skin of an adult female collected June 21, 1896, by P. O. Simons, original number 212. Through the courtesy of Dr. George S. Myers, Curator of the zoological collections of Stanford University, the specimen was loaned for comparison with others in the United States National Museum. Because of the predominance of reddish color in the inner pair of pale dorsal stripes, it is assigned to the subspecies *ochraceus*, although in small size and generally pallid coloration it can scarcely be distinguished from certain specimens of *E. a. monoensis* from the western slope of the central

Sierra Nevada. A series of specimens from Snow Mountain is needed for more positive determination.

Snow Mountain has an elevation of approximately 7,000 feet and bears on its upper slopes the southernmost example of the Canadian Life-zone of the inner Coast Ranges. An altitudinally and zonally lower ridge connects it with the large Yolla Bolly Range, some 50 miles to the northward. Another chipmunk, *Eutamias townsendii senex*, and a chickaree, *Tamiasciurus douglasii albolimbatus*, are Canadian Zone mammals that have previously been recorded from Snow Mountain. Future mammal collecting should be directed toward search there for other Boreal species.

A third chipmunk from Snow Mountain is *Eutamias sonomae sonomae*, a lower-zone form that is widely distributed over the surrounding area.—David H. Johnson, *United States National Museum, Washington, D. C.*

### RECENT RECORD OF THE JAGUAR IN TEXAS

On January 30, 1946, a 159-pound jaguar (*Felis onca*) was killed by Analdo Martinez on the Barreda place near San Benito in Cameron County, Texas. According to Charles G. Jones, District Game Warden, Texas Game Fish and Oyster Commission, the animal was killed on the Barreda tract, 2½ miles southwest of Barreda (now known as Russelltown) and 6 miles southeast of San Benito, Cameron County. He stated that the jaguar had been in the vicinity for some time, and was locally deemed responsible for the slaughter of 28 yearling cattle over a three-week period.

According to C. R. Landon, District Agent, Fish and Wildlife Service, San Antonio, there are no recent records for the jaguar in Texas. Charles G. Jones refers to one killed about 35 years ago near the town of Lyford in Willacy County. But formerly the jaguar, the "El Tigre" of the Mexicans, was found pretty widely through Texas, easterly probably or possibly into Louisiana and north to the Red River. Localities of occurrence include Center City, Mills County, Texas, as late as September 3, 1903 (Bailey, North American Fauna, no. 25, 1905, p. 163), 10 miles south of Carrizo Springs in Dimmit County, south of Jasper, along the Neches River, near Beaumont, and in the timber south of Conroe in Montgomery County, near the mouth of the Pecos in Val Verde County, and south of Comstock in the same county. Vernon Bailey pointed out that a skin from the "Brazos River, Texas," without a date, obtained from one J. M. Stanley, was entered in the National Museum catalog in 1853 and described in detail by Professor Spencer F. Baird in the Mexican boundary survey (Mammals of the Boundary, vol. 2, p. 2, pp. 6–7), but the skin seemed to have disappeared. According to Bailey the jaguar has been reported from the Live Oak Peninsula, Aransas County, as well as from Goldthwaite in Mills County.—Walter P. Taylor, *Texas Cooperative Wildlife Research Unit, College Station, Texas.*

### THE ABERT SQUIRREL IN UTAH

A specimen of the Abert squirrel, *Sciurus aberti*, was recently collected in Utah by George F. Edmunds and Irving B. McNulty of the Department of Biology, University of Utah. The locality of capture is one mile east of the Kigalia Ranger Station, 30 miles west of Blanding, on the Natural Bridges National Monument Road, 8,000 feet altitude, San Juan County, Utah. It was taken in the western yellow pine (*Pinus ponderosa*) forest interspersed with oak (*Quercus gambelii*), in the La Sal National Forest.

Insofar as I am informed, this animal represents the first specimen of this species ever to be obtained in Utah. From the known distribution of the various subspecies, this single specimen seems best referred provisionally to the race *Sciurus aberti mimus*. Additional specimens may reveal different information since this area represents a relatively isolated region of the aforementioned vegetative type, which seems to be the usual predilection of these animals.—Stephen D. Durrant, *Department of Biology, University of Utah, Salt Lake City, Utah.*

### THE STATUS OF THE GENERA ANAPTOGONIA AND SYCIUM COPE

Cope, 1871 (Proc. Amer. Philos. Soc., vol. 12, p. 91), proposed *Anaptogonia* as a new subgenus of *Arvicola* for the species *hiatidens* (holotype no. 8698, Amer. Mus. Nat. Hist., a left $M_1$). Cope defined the *Anaptogonia* group of microtines as those in which, "none of the triangles of $M_1$ are isolated but are connected by a narrow strip of dentine, which narrows posteriorly but widens anteriorly until it opens out into the terminal loop."

In 1896 (Proc. Acad. Nat. Sci. Philadelphia, p. 379), Cope raised *Anaptogonia* to generic rank on the basis of the characters of the teeth, "Pulp cavity and lateral grooves closed below, with teeth rooted." Cope had at hand additional material for study which possessed closed triangles in the molars and he considered the condition of open triangles observed in the holotype as only an individual difference.

I am convinced, after the examination of the holotype and topotypes of *Anaptogonia hiatidens*, that they belong to the genus *Ondatra* Link (1795) and the correct name, therefore, becomes *Ondatra hiatidens* (Cope).

Cope, 1896 (*op. cit.*, p. 380), named and described *Anaptogonia cloacina*, which was based on four upper teeth, in which he observed the following characters, "the common pulp cavity with lateral walls which close the lateral grooves, but do not close the pulp cavities; no roots." The description was based on what Cope considered to be two specimens; the first, $M^2$ and $M^3$; the second $M^1$ and $M^2$. In a posthumous paper, 1899 (Jour. Acad. Nat. Sci. Philadelphia, vol. 11, 2nd ser., p. 203), he described the genus *Sycium*, the genotype being *Anaptogonia cloacina* Cope. I examined the type series (no. 147, Acad. Nat. Sci. Philadelphia) January 2, 1946. In the vial were two right $M^2$, a right and a left $M^1$, and a right $M^3$. Cope 1899 (*op. cit.*, p. 204), figured a right and a left $M^1$ which bears out the fact that he himself added an additional upper tooth to the series. The isolated teeth are those of young animals, with open roots. The distal part of all the roots appear to have been broken in removing the teeth from the matrix. It is evident that there are two or more individuals in the material which is labeled as Cope's type. These specimens, therefore, are cotypes. Since Cope did not designate a holotype, I, therefore, designate as the lectotype of *Sycium cloacinum* (Cope), the first tooth figured on page 204, the right $M^1$ of the series, no. 147, Mus. Acad. Nat. Sci. Philadelphia.

From a study of this series of teeth of *Sycium cloacinum* (Cope) it was observed that they are immature upper teeth of *Ondatra hiatidens* (Cope). *Sycium cloacinum* (Cope) is, therefore, a synonym of *Ondatra hiatidens* (Cope).—Claude W. Hibbard, *Museum of Natural History, University of Kansas, Lawrence, Kansas.*

### THE HISTORY OF THE TYPE OF PACHYOTIS TEMMINCKII PANAYENSIS SODY

In 1928 H. J. V. Sody (Natuur. Tijds. Neder. Ind., vol. 88, p. 90, 1928) named a *Scotophilus* from Panay Island, Philippine Islands, as *Pachyotis temminckii panayensis*. He had no specimens and designated no type basing the name on the size of the forearm as given by Elliot (Field Col. Mus., Zool. Ser., vol. 1, p. 71, 1896) for four specimens in the then Field Columbian Museum. Elliot had described the specimens as "exactly alike and have the entire upper parts Prout's Brown, under parts pale buff. Forearm $1\frac{7}{8}$ inches," which is equal to 48 mm.

The four specimens were collected by D. C. Worcester and F. S. Bourns on the Menage Scientific Expedition on October 22, 1890. One specimen bears the locality Capiz and the others Panay, but, being taken the same day, probably all came from the town of Capiz on the north coast of the island. They are prepared with the wings spread and under sides open from the throat to the tail. The leg, wing, and tail bones are complete in each specimen, but the skins are somewhat soiled. Two are males, penis still on skin, but labeled with the female sex mark upside down. The other two are females, one properly labeled and the other by the male sex mark upside down. They are now Chicago Natural History Museum specimens numbered 1110 ♀, 1111 ♂, 1112 ♂, and 1113 ♀. The skull of 1113 is broken but the others are in good condition.

The color of the series is uniform, Prout's Brown (Ridgway, Color Standards, 1912) above and between Cinnamon Buff and Clay Color on the underparts.

Specimen number 1110 ♀, is hereby designated as the lectotype. Its measurements (paratypes in brackets) are: Forearm, 52.5 mm. (49.5–51.9); tail, 41.5 (36–37); tibia, 18.6 (18.6–20.3); foot, 10.6 (10–10.5). Skull: Greatest length, 19 (19.5–19.9); condylobasal length, 17.6 (17.6–17.6); palatal length, 6.9 (6.8–7.6); rostral width, 8 5 (8.3–8.5); interorbital width, 5.1 (4.5–4.7); zygomatic width, 13.6 (13–13.5); mastoid width, 11 (11.3–11.4); width of braincase, 9.1 (8.8–9); length upper tooth row, c-m,$^3$ 6.4 (6.6–6.8); width across canines, 6.1 (6.1–6.6); width across molars, 8.5 (8.4–8.4); lower tooth row, c-m$_3$, 7.1 (7.5–7.6).

Taylor (Philippine Land Mammals, p. 306, 1934) did not refer to *panayensis* and identified all Philippine specimens as *temminckii*. Lawrence (Bull. Mus. Comp. Zool., vol. 86, p. 58, 1939) did not mention the race in her remarks on Philippine specimens of *temminckii*. Tate (Bull. Amer. Mus. Nat. Hist., vol. 80, pp. 286–287, 1942) reviewed the history of the race, remarked that Lawrence had much larger specimens from the Philippines, and expressed the idea that *panayensis* was "a weak variant race or individual variant of a single widely dispersed specimens."

The Chicago Natural History Museum has two specimens taken at Iloilo, Panay Island, in 1937. These are lighter in color than the series under discussion, being Snuff Brown above and close to Cinnamon Buff below, especially on the throat. The forearm of the male measures 49.5 mm. The skulls are slightly narrower. Seven specimens from Luzon Island have forearms measuring from 48.6 to 53 mm. in length.

Sody was misled by Elliot's inaccurate measurements, and other specimens do not point to there being a smaller race on Panay Island. The color seems so variable in this species that, from available evidence, it could not be used as a subspecific character for this race.

The name *Pachyotus temminckii panayensis* Sody should, therefore, become a synonym of *Scotophilus temminckii temminckii* Horsfield.—Colin Campbell Sanborn, *Chicago Natural History Museum, Chicago 5, Illinois.*

### A CORRECTION

In a recent article entitled "Designation d'un lectotype de *Callithrix penicillatus* (E. Geoffroy)," (Bull. Mus. d'Hist. Nat., ser. 2, vol. 17, pp. 221–2, 1945), the authors noted the loss of the type specimen of *Jacchus penicillatus* Geoffrey, 1812, and they deemed it desirable to designate another specimen in the collections of the Paris museum as a *lectotype*. Unfortunately, the individual selected cannot be a *lectotype* as it is definitely not one of the original series examined by Geoffroy. This specimen is one of four collected in 1822 by August Geoffroy Saint-Hilaire in the capitanerie of Goyaz, Brazil. In view of the restriction of the type locality of *C. penicillata* to Lamarão, near Bahia, by Thomas (Ann. & Mag. Nat. Hist., ser. 7, vol. 14, p. 188, 1904), the Goyaz specimen cannot even be regarded as a *neotype*. Instead, it proves to be referrable to *Callithrix penicillata jordani* Thomas. Attention is called to the fact that Humboldt, who first published Geoffroy's description of the marmoset, should be cited as the author of *Callithrix penicillata*.—Philip Hershkovitz and Paul Rode, *U. S. National Museum, Washington. D. C., and Muséum National d'Histoire Naturelle, Paris, France.*

# REVIEWS

**Rode, P. and Didier, R.** ATLAS DES MAMMIFÈRES DE FRANCE. Editions N. Boubée & Cie, Paris, pp. 1–219, 12 pls. colored, 3 pls. uncolored, 114 figs. in text, type bed 3¼ x 6 inches, paper cover, 1946.

This compact brochure is intended to encourage amateur mammalogists and to promote popular interest in mammalogy by making available an inexpensive (price not stated) pocket-sized publication by means of which any kind of wild mammal living in France today can readily be identified.

The scientific name and common name for each species is followed by a statement of diagnostic morphological characters, description of color, measurements (external and cranial), weight, geographic distribution, selected natural history information, information on reproduction, and a list of geographic forms (subspecies) together with an indication of the geographic range of each form. Figures in the text portray the dentition, and other features in satisfactory, although not a superior, fashion. The colored plates, comprising 70 paintings, of as many kinds of mammals, all by L. Delapchiez, are a valuable feature of the book. Most of the paintings are good and many are superior.

The living Marsupialia are said (p. 8) to be limited to Australia and South America; *Mustela erminea* is credited with a gestation period of only 60 days without any mention of the preimplantation period of the zygote; the system of numbering the teeth implies that the reduction in number of premolars in bats is accomplished by loss of teeth at the posterior end of the series. Errors or questionable statements of this kind are few. The book might have been more useful to amateurs if common names of geographic forms had been omitted in favor of one common name applied to all of the subspecies of any one species. The three pages of photographs of skulls in quality of reproduction are inferior to the other illustrations in the book. Some of the points just mentioned are only matters of personal opinion, but even if all of them be admitted as just criticisms they detract but little from the worth of the book. It will serve usefully its intended purpose, and the authors along with their institution and sponsoring benefactors, are to be congratulated on so tastefully and authoritatively expounding mammalogy for the general public.—E. R. HALL.

**Asdell, A. S.** PATTERNS OF MAMMALIAN REPRODUCTION. Comstock Publishing Co., vii + 437 pp., 12 pls. 1946. Price $5.00.

For the first time workers in the fields of mammalogy and physiology of reproduction have available in "*Patterns of Mammalian Reproduction*" an encyclopedic reference to the reproductive behavior and patterns of mammals, both domestic and feral, and even of man himself. The scope is worldwide.

The author, now Professor of Animal Physiology at Cornell University, has brought together here information from hundreds of references in the vast literature on the subject and organized it in a readily accessible fashion. Following a brief introductory chapter on the physiology and anatomy of sex, each Order of living mammals is treated in systematic sequence. For the some 200 species in which the reproductive pattern is fairly well known, the information is treated in separate articles. The accounts of domestic and laboratory mammals, and of man, are exceptionally full and complete. For example, 20 pages of text are devoted to, and 150 references cited for, the rat (*Rattus rattus*) alone. But for some 700 additional species the data are presented only in tabular form.

Perusal of these tables reveals the appalling dearth of information on the details of reproduction for most of our common and widespread mammals. For example, in only 4 of the 103 species of bats treated is the gestation period known, and for most of the 103 the breeding season is not even known! The reviewer heartily seconds the author's suggestion that the matter of reproduction in wild animals "might profitably be explored to the benefit of science and of the practical man, be he conservationist, pest controller, or animal breeder." Nothing is of more practical value than complete and accurate life-history data of the animals with which we live.

In an undertaking of this scope, it is almost inevitable that some references should be omitted and that some errors should creep in. For example, no data are given for the bat *Balantiopteryx plicata* or the spotted skunk *Spilogale interrupta*, information on both of which were published in this Journal in 1944. Perhaps this is to be explained by the fact that the author did not peruse the literature beyond 1943, but there is no indication in the text that this is the case. It would be helpful, it seems, to know definitely the year beyond which no data were admitted to the book. On page 291 and again on 292, the family name of the jumping mice is given as "Zapotidae." These are minor points and hardly detract from the value and usefulness of the book. More serious, however, is the failure to give sources of data in the tables for the some 700 species of mammals treated in tabular form only, other than the names of the authors of the articles consulted. For this omission censure is due because other workers are thereby denied a tool that the author should have provided.

In spite of any deficiencies that the book may have, it is a real contribution to the field of mammalogy and certainly offers a solid foundation on which to build, as well as a ready reference to most of the data on the subject of animal reproduction. No serious mammalogist or animal physiologist can afford not to have "*Patterns of Mammalian Reproduction*" readily available for consultation. Graduate students casting about for desirable research problems will find the book especially useful.—W. B. Davis.

---

## RECENT LITERATURE

(Conducted by Gerrit S. Miller, Jr., Remington Kellogg, and Emma M. Charters)

[Reprints of this section may be purchased from the Corresponding Secretary]

Abbott, Jacob Bates. Atomic power in fur. Pennsylvania Game News, Harrisburg, vol. 16, no. 10, pp. 3, 20–21, illus. January, 1946. (Wolverene.)

Abolinš-Krogis, Anna. Eine Modifikation der Zellzählungsmethode am Hypophysenvorderlappen des Meerschweinchens (Cavia porcellus L.). Arkiv f. Zool., Uppsala, vol. 37A, no. 12, pp. 12, figs. 3. January 10, 1946.

Allen, Edgar, Thurlo B. Thomas, James G. Wilson, and Dorothy A. Hession. Differential growth in the ovaries and genital tract near the time of ovulation in rats treated with colchicine. Amer. Jour. Anat., Philadelphia, vol. 72, no. 2, pp. 291–337, figs. 1–5, pls. 1–5. March, 1943.

Allison, Eaves. The fish-hole bear. Field and Stream, New York, vol. 50, no. 8, pp. 52–54, 95. December, 1945.

Allyn, Paul M. Feeding and care of mink. Fur-Fish-Game (Harding's Mag.), Columbus, vol. 79, no. 1, pp. 28–29. January, 1946.

Ames, Oakes I. Squirrels and bird window feeders. Bull. Massachusetts Audubon Soc., Boston, vol. 29, no. 10, pp. 311–312. January, 1946.

Anders, M. V. The histopathology of a new type of hereditary loss of coordination in the domestic rabbit. Amer. Jour. Anat., Philadelphia, vol. 76, no. 2, pp. 183–199, figs. 1–3, pls. 1–2. March, 1945.

Anderson, Rudolph Martin. Richardson's ermine added to the list of Quebec mammals with a survey of the weasels found in the province. Rapport Annuel 1945 Société Provancher, Québec, pp. 20–32. 1946.

Andersson, J. G. Nordkinesiska klimatväxlingar. Ymer (Tidsk. Svenska Sällsk. Antropol. Geogr.), Stockholm, 1943, no. 2, pp. 82–100. (Seven tropical genera of mammals listed.)

Andrew, Warren. Senile changes in the pancreas of Wistar Institute rats and of man with special regard to the similarity of locule and cavity formation. Amer. Jour. Anat., Philadelphia, vol. 74, no. 1, pp. 97–127, pls. 1–6. January, 1944.

Andrew, Warren, Harry Marshall Brown, and James Bluford Johnson. Senile changes in the liver of mouse and man, with special reference to the similarity

of the nuclear alterations. Amer. Jour. Anat., Philadelphia, vol. 72, no. 2, pp. 199–221, pls. 1–4. March, 1943.

ANDREWS, ROY CHAPMAN. Meet your ancestors. A biography of primitive man. Viking Press, New York, pp. xii + 259, illus. 1946.

ANONYMOUS. Rabbit raising in Hawaii. Hawaii Agric. Ext., Honolulu, Circ. no. 177, pp. 1–10, illus. August, 1945.

——— England's wild moorland ponies. Nat. Geogr. Mag., Washington, vol. 89, no. 1, pp. 129–136, 10 photos. January, 1946.

ASHLEY, LAURENCE M. A determination of the diameters of ventricular myocardial fibers in man and other mammals. Amer. Jour. Anat., Philadelphia, vol. 77, no. 3, pp. 325–363, fig. 1, pls. 1–2. November, 1945.

ATKESON, F. W., FRANKLIN ELDRIDGE, and H. C. FRYER. An unusual case of twinning in Jersey cattle. Jour. Heredity, Washington, vol. 34, no. 3, pp. 81–82, illus. March, 1943.

ATKESON, F. W., FRANKLIN ELDRIDGE, and HEMAN L. IBSEN. Bowed pastern in Jersey cattle. Jour. Heredity, Washington, vol. 34, no. 1, pp. 25–26, figs. 14–15. January, 1943.

ATKESON, F. W., HEMAN L. IBSEN, and FRANKLIN ELDRIDGE. Inheritance of an epileptic type character in Brown Swiss cattle. Jour. Heredity, Washington, vol. 35, no. 2, pp. 45–48, fig. 5. February, 1944.

BALTZO, C. HOWARD. Goats above the glacier. Alaska Sportsman, Ketchikan, vol. 11, no. 9, pp. 18–20, 23–28, illus. September, 1945.

BASSETT, DAVID L. The changes in the vascular pattern of the ovary of the albino rat during the estrous cycle. Amer. Jour. Anat., Philadelphia, vol. 73, no. 2, pp. 251–291, pls. 1–5. September, 1943.

BATE, DOROTHEA M. A. The Pleistocene mole of Sardinia. Ann. and Mag. Nat. Hist., London, ser. 11, vol. 12, no. 91, pp. 448–461. February 20, 1946. (New: *Talpa tyrrhenica.*)

BENCHLEY, BELLE J. The bearded baby. San Diego Zoonooz, vol. 19, no. 1, p. 7, illus. January, 1946. (Guenon.)

BENNETT, HUGH H. How soil conservation aids wildlife. Audubon Mag., New York, vol. 46, no. 2, pp. 76–86, illus. March–April, 1944.

BERLIN, HERVED, and ERIK MOHRÉN. Zwei Reisenhirschfunde aus Südschweden. Lunds Geologiska Faltklubb 1892–1942, Lund, pp. 1–30, figs. 1–6. 1942.

BHALERAO, G. D. On the occurrence of the bat fluke, *Prosthodendrium ovimagnosum* (Bhalerao, 1926) in a dog. Records Indian Mus., Calcutta, vol. 43, pt. 4, pp. 415–416. December, 1941.

BLAKE, FRANCIS G., KENNETH F. MAXCY, JOSEPH F. SADUSK, JR., GLEN M. KOHLS, and E. JOHN BELL. Studies on tsutsugamushi disease (scrub typhus, miteborne typhus) in New Guinea and adjacent islands: epidemiology, clinical observations, and etiology in the Dobadura area. Amer. Jour. Hygiene, Baltimore, vol. 41, no. 3, pp. 243–373, figs. 32, pls, 3. May, 1945. (Mammals, pp. 265–274.)

BLANDAU, RICHARD J. On the factors involved in sperm transport through the cervix uteri of the albino rat. Amer. Jour. Anat., Philadelphia, vol. 77, no. 2, pp. 253–272, fig. 1. September, 1945.

BLUNN, CECIL T. Characteristics and production of old-time Navajo sheep. Jour. Heredity, Washington, vol. 34, no. 5, pp. 141–152, figs. 6–10. March, 1943.

BOËTHIUS, BERTIL. Jakt och fiske i Norrland i äldre tid. Ymer (Tidsk. Svenska Sällsk. Antropol. Geogr.), Stockholm, 1942, nos. 3–4, pp. 421–448.

BOLLINGER, ADOLPH, and MARGARET H. HARDY. The sternal integument of *Trichosurus vulpecula*. Jour. and Proc. Roy. Soc. New South Wales, Sydney, vol. 78, pt. 3, pp. 122–133, pls. 4–7. December 3, 1945.

BOWER, WARD T. Alaska fishery and fur seal industries: 1944. U. S. Dept. Interior, Fish and Wildlife Serv., Washington, Statistical Digest no. 13, pp. 1–79, illus. 1946.

BREUER, RICHARD. Zwei Fälle bemerkenswerter anatomischer Befunde an Schädeln kleinerer Säugetiere. Zool. Anzeiger, Leipzig, vol. 144, nos. 1–2, pp. 34–37, figs. 1–4. October 15, 1943. (*Vulpes* and *Erinaceus*.)

BRUMMELKAMP, R. On the cephalization stage of Pithecanthropus erectus and Sinanthropus pekinensis. Proc. K. Nederlandsche Akad. Wetensch., Amsterdam, vol. 43, no. 6, pp. 741–752, figs. 1–3. June, 1940.

BUSHNELL, RALPH J. Linked color factors in Hampshire swine. Linkage of black and the basic white of the white belt pattern. Jour. Heredity, Washington, vol. 34, no. 10, pp. 302–307, figs. 8–10. October, 1943.

CABRERA, ANGEL. Sobre algunas cornamentas de Blastocerus dichotomus. Notas Mus. La Plata, vol. 10. zool., no. 87, pp. 221–231, figs. 1–3. December 14, 1945.

CAMPBELL, C. M. Corn fed squirrels. Pennsylvania Game News, Harrisburg, vol. 16, no. 9, pp. 3, 24–25, illus. December, 1945.

CASTELLANOS, ALFREDO. Punta de Flecha Osea descubierta en el Pampeano medio del Arroyo Saladillo (Rosario, Santa Fe). Publ. Inst. Fisiografia y Geol., Rosario, no. 22, pp. 1–32, figs. 13. 1944.

——— Paleontologia estratigráfica de los sedimentos neógenos de la Provincia de Córdoba. Publ. Inst. Fisiografia y Geol., Rosario, no. 23, pp. 1–47. 1944.

——— Notas sobre algunas cornamentas de ciervos de los géneros Epieuryceros, Antifer y Paraceros y descripción de la de Epiuryceros [sic] proximus n. sp. Publ. Inst. Fisiografia y Geol., Rosario, no. 24, pp. 1–21, figs. 22. 1945. (New: *Epieuryceros proximus*.)

CHAMBERS, ROBERT, and B. W. ZWEIFACH. Topography and function of the mesenteric capillary circulation. Amer. Jour. Anat., Philadelphia, vol. 75, no. 2, pp. 173–205, figs. 1–2, pls. 1–3. September, 1944. (Dog and rat.)

CHASE, ELIZABETH BROWN. Inheritance of imperforate vagina in the mouse. Jour. Heredity, Washington, vol. 35, no. 12, pp. 363–364. December, 1944.

CHITTY, HELEN, and DENNIS CHITTY. Canadian Arctic wild life enquiry, 1942–43. Jour. Anim. Ecol., London, vol. 14, no. 1, pp. 37–45. May, 1945.

CLARK, ELIOT R., and ELEANOR LINTON CLARK. Caliber changes in minute blood-vessels observed in the living mammal. Amer. Jour. Anat., Philadelphia, vol. 73, no. 2, pp. 215–250, figs. 1–7. September, 1943.

CLOUDMAN, ARTHUR M., and LESTER E. BUNKER, JR. The varitint-waddler mouse. A dominant mutation in Mus musculus. Jour. Heredity, Washington, vol. 36, no. 9, pp. 258–263, fig. 1. September, 1945.

COATS, G. W. A March deer hunt fifty-eight years ago. South Dakota Conserv. Digest, Pierre, vol. 12, no. 10, pp. 14–15. October, 1945.

——— Some observations on wildlife in the Black Hills during the past sixty-five years. South Dakota Conserv. Digest, Pierre, vol. 12, no. 11, pp. 10–11, 15. November, 1945.

COLAHAN, ELLWOOD. Coyotes from the air. Field and Stream, New York, vol. 50, no. 9, pp. 42–43, illus. January, 1946.

COLE, H. H., C. F. HUFFMAN, MAX KLEIBER, T. M. OLSON, and A. F. SCHALK. A review of bloat in ruminants. Jour. Anim. Sci., Menasha, vol. 4, no. 3, pp. 183–236. August, 1945.

COLE, LEON J., and W. A. CRAFT. An acephalic lamb monster in sheep and its relation to single-egg twinning in sheep. Jour. Heredity, Washington, vol. 36, no. 1, pp. 29–32, figs. 19–20. January, 1945.

CORBETT, JIM. Man-eaters of Kumaon. Oxford Univ. Press, New York, pp. xix + 235, illus. 1946. (Tigers.)

COUTO, CARLOS DE PAULA. Sobre un macrauquénido gigante Macraucheniopsis gen. nov. del Pampeano Inferior de la Argentina. Notas Mus. La Plata, vol. 10, paleontol., no. 84, pp. 233–257, figs. 1–5. 1945. (New: *Macraucheniopsis*, for *Macrauchenia ensenadensis* Ameghino.)

COWAN, IAN MCTAGGART. The free-tailed bat, *Tadarida macrotis*, in British Columbia. Canadian Field-Nat., Sutton West, vol. 59, no. 4, p. 149. July–August, 1945.

CRANDALL, LEE S. Family affairs on Gibbon Island. Animal Kingdom, New York, vol. 48, no. 6, pp. 165–167, illus. November–December, 1945. (Gibbon.)

DALQUEST, WALTER W. A new name for the desert race of the bat, Myotis californicus. Proc. Biol. Soc. Washington, vol. 59, pp. 67–68. March 11, 1946. (New: *Myotis californicus stephensi*.)

DAVIS, DAVID E. The annual cycle of plants, mosquitoes, birds, and mammals in two Brazilian forests. Ecol., Monographs, Durham, vol. 15, pp. 243–295, figs. 24. July, 1945.

DAWSON, ALDEN B., and BETTY ANN KOSTERS. Preimplantation changes in the uterine mucosa of the cat. Amer. Jour. Anat., Philadelphia, vol. 75, no. 1, pp. 1–37, pls. 1–5. July, 1944.

DECKER, MAURICE H. Loads for deer and vermin. Fur-Fish-Game (Harding's Mag.), Columbus, vol. 79, no. 1, pp. 14–17. January, 1946.

DEGERBØL, MAGNUS. Halvgrindehvalen (Grampus griseus Cuv.) strandet i Danmark. Naturens Verden, Copenhagen, 1939, pp. 226–232, figs. 4.

——— Hvidsiden eller Hvidskaevingen, (*Lagenorhynchus acutus* Gray) i danske Farvande. Naturens Verden, Copenhagen, 1943, pp. 164–174, figs. 8.

DEGERBØL, MAGNUS, and JOHS. IVERSEN. The bison in Denmark. A zoological and geological investigation of the finds in Danish Pleistocene deposits. Danmarks Geologiske Undersøgelse, Copenhagen, ser. 2, no. 73, pp. 1–62, figs. 13, pls. 7. 1945.

DEGERBØL, MAGNUS, and U. MØHL-HANSEN. Remarks on the breeding conditions and moulting of the collared lemming (Dicrostonyx). Meddelelser om Grønland, Copenhagen, vol. 131, no. 11, pp. 1–40, figs. 27. 1943.

DEVOE, ALAN. Nature, the overseer. Audubon Mag., New York, vol. 45, no. 5, pp. 270–276. September–October, 1943. (Red fox, rabbit.)

——— Winter watching. Audubon Mag., New York, vol. 47, no. 1, sec. 1, pp. 2–8, illus. January–February, 1945. (General notes.)

DICKIE, MARGARET M. A unique "Himalayan" mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 264–265, figs. 2–3. September, 1945.

DOBZHANSKY, TH. Genetics and macro-evolution. A review [of "Tempo and mode in evolution," by G. G. Simpson, 1944]. Jour. Heredity, Washington, vol. 36, no. 4, pp. 113–115. April, 1945.

DORER, RICHARD J. Concerning Minnesota's deer herd. Minnesota Div. Bull. Isaac Walton League, 4th Quarter, 1945, pp. 18–19. December, 1945.

DOTTRENS, EMIL. Determination des phalanges osseuses de *Bos taurus dom.* Compte Rendu Soc. Phys. et Hist. Nat. Geneve, Geneva, vol. 63, no. 1, pp. 46–49. January–March, 1946.

DOWNING, STUART C. The Rocky Mountain goat. Canadian Nat., Toronto, vol. 8, no. 1, pp. 14–15, col. pl. January, 1946.

DOWNS, T. MCKEAN. Family life of the fur seal. Frontiers, Lancaster, vol. 10, no. 2, pp. 35–37, 62–63, illus. December, 1945.

DUFRESNE, FRANK. It's an armadillo. Nature Mag., Washington, vol. 38, no. 10, pp. 527–528, 552. December, 1945.

DVOSKIN, SAMUEL. Local maintenance of spermatogenesis by intratesticularly implanted pellets of testosterone in hypophysectomized rats. Amer. Jour. Anat., Philadelphia, vol. 75, no. 3, pp. 289–327, pls. 1–4. November, 1944.

EATON, ORSON N., and E. SCHWARZ. The "snowy belly" mouse. A dominant allele of the agouti series in the house mouse. Jour. Heredity, Washington, vol. 37, no. 1, pp. 31–32. January, 1946.

EISELEY, LOREN C. Indian mythology and extinct fossil vertebrates. Amer. Anthropol., Menasha, n. s., vol. 47, no. 2, pp. 318–320. April–June, 1945.

HEUVELMANS, B[ERNARD]. Notes sur la dentition des siréniens. IV. Le cas de Prorastoma veronense. Bull. Mus. Roy. Hist. Nat. Belgique, Brussels, vol. 18, no. 3, pp. 1–6, figs. 4. January, 1942.

——— Notes sur la dentition des siréniens. Bull. Mus. Roy. Hist. Nat. Belgique, Brussels, vol. 19, no. 29, pp. 1–16. May, 1943.

HEVESY, G., and L. HAHN. Rate of renewal of the acid soluble organic phosphorus compounds in the organs and the blood of the rabbit with a note on the duration of life of the red blood corpuscles. Kgl. Danske Videnskab. Selskab., Biol. Meddel., Copenhagen, vol. 15, no. 7, pp. 36. September 21, 1940.

HIRTLE, F. C. Occurrence of the rock vole in New Brunswick. Acadian Nat., Fredericton, vol. 2, no. 6, pp. 112–113. January, 1946.

HOLLINSHEAD, W. HENRY. A cytological study of the carotid body of the cat. Amer. Jour. Anat., Philadelphia, vol. 73, no. 2, pp. 185–213, pl. 1. September, 1943.

HOOKER, CHARLES W. The postnatal history and function of the interstitial cells of the testis of the bull. Amer. Jour Anat., Philadelphia, vol. 74, no. 1, pp. 1–37, fig. 1, pls. 1–5. January, 1944.

HORIKAWA, YASUICHI. On the nomenclature of the Formosan pangolin. [Translated title.] Trans. Nat. Hist. Soc. Taiwan, Taihoku, vol. 33, no. 234, pp. 67–70. March, 1943. (In Japanese.)

HOYT, VANCE. The doctor goes wild. Nature Mag., Washington, vol. 38, no. 9, pp. 482–498, illus. November, 1945. (Cougar, deer, bobcat, ring-tailed cat, fox, raccoon, coyote, skunk.)

HUSTED, LADLEY, J. T. HOPKINS, JR., and M. B. MOORE, JR. The X-bivalent of the golden hamster. Jour. Heredity, Washington, vol. 36, no. 3, pp. 93–96, fig. 9. March, 1943.

HUXLEY, JULIAN S. Species and evolution. Endeavor, London, vol. 5, no. 17, pp. 3–12, figs. 1–9. January, 1946.

ILJIN, N. A. The role of heredity in response to a drug as demonstrated by the experimental molt of rabbits induced by toxic thallium compounds. Jour. Heredity, Washington, vol. 36, no. 3, pp. 85–91, figs. 6–8. March, 1945.

IRVING, LAURENCE. The respiration of beaver. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 9, no. 3, pp. 437–451, figs. 9. April, 1937.

——— Changes in the blood flow through the brain and muscles during the arrest of breathing. Amer. Jour. Physiol., Baltimore, vol. 122, no. 1, pp. 207–214, figs. 6. April, 1938.

——— The insensitivity of diving animals to $CO_2$. Amer. Jour. Physiol., Baltimore, vol. 124, no. 3, pp. 729–734. December, 1938.

——— Respiration in diving mammals. Physiol. Rev., Baltimore, vol. 19, no. 1, pp. 112–134. January, 1939.

——— The action of the heart and circulation during diving. Trans. New York Acad. Sci., ser. 2, vol. 5, no. 1, pp. 11–16. October 12, 1942.

IRVING, LAURENCE, V. SAFFORD, and W. J. SCOTT. Properties of fox blood for respiratory transport. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 13, no. 3, pp. 297–302, fig. 1. June, 1939.

IRVING, LAURENCE, P. F. SCHOLANDER, and S. W. GRINNELL. The respiration of the porpoise, Tursiops truncatus. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 17, no. 2, pp. 145–168. April 21, 1941.

——— Significance of the heart rate to the diving ability of seals. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 18, no. 3, pp. 283–297, figs. 5. December 20, 1941.

——— The regulation of arterial blood pressure in the seal during diving. Amer. Jour. Physiol., Philadelphia, vol. 135, no. 3, pp. 557–566. February, 1942.

——— Experimental studies of the respiration of sloths. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 20, no. 2, pp. 189–210, figs. 13. October 20, 1942.

Isberg, Orvar. Einige Renntierfunde aus der postglazialen Zeit Schonens. Lunds Geologiska Faltklubb 1892–1942, Lund, pp. 1–6, figs. 1–2. 1942.

Jaeger, Ellsworth. Animal tracks. Canadian Nat., Toronto, vol. 8, no. 1, pp. 16–21, illus. January, 1946.

Jillson, Willard Rouse. Big bones at Lower Blue Licks. Notes on the history, geology and paleontology of a famous Kentucky fossil locality. Privately published, Louisville, 11 pp., 1 pl. 1946.

Johansson, Hilding. Renskötseln. Ymer (Tidsk. Svenska Sällsk. Antropol. Geogr.), Stockholm, 1942, nos. 3–4, pp. 403–420, figs. 1–7. (Reindeer.)

Johnson, David H. Quintuple lambs of woolless domestic sheep. Jour. Heredity, Washington, vol. 35, no. 8, pp. 251–253, figs. 13–14. August, 1944.

Johnson, Leslie E. Fused teats. A hereditary defect in beef cattle. Jour. Heredity, Washington, vol. 36, no. 10, pp. 317–320, figs. 13–14. October, 1945.

Kaughphy, Edward. Big horn sheep of Yuma County. Arizona Wildlife and Sportsman, Tucson, vol. 7, no. 1, pp. 4, 8. January, 1946.

Keeler, Clyde E. Coat color and temperament in mules. Jour. Heredity, Washington, vol. 36, no. 8, p. 243. August, 1945.

Kempf, J. Emerson, and J. Arthur Herrick. The production of osteomyelitis in rats. Ohio Jour. Sci., Columbus, vol. 46, no. 1, pp. 1–4. January, 1946.

Kingsbury, B. F. On the so-called laryngeal tonsils of mammals; with special reference to their structure and development in the cat. Amer. Jour. Anat., Philadelphia, vol. 72, no. 2, pp. 171–197, pls. 1–3. March, 1943.

——— Tonsillar epithelium and the lymphocyte: an examination of the palatine tonsil of the cat. Amer. Jour. Anat., Philadelphia, vol. 75, no. 2, pp. 233–261, pls. 1–3. September, 1944.

——— Lymphatic tissue and regressive structure, with particular reference to degeneration of glands. Amer. Jour. Anat., Philadelphia, vol. 77, no. 2, pp. 159–187, pls. 1–4. September, 1945. (In the cat.)

Kirkman, Hadley. The number and distribution of macrophages and fibroblasts in kidneys of albino rats with emphasis on twenty-five day males. Amer. Jour. Anat., Philadelphia, vol. 73, no. 3, pp. 451–482, figs. 1–5. November, 1943.

Koby, F.-Ed. Un squelette d'ours brun du pléistocène italien. Verhandl. Naturforsch. Gesell. Basel, vol. 56, pt. 1, pp. 58–85, figs. 1–5. 1945.

Kohls, Glen M., Charles A. Armbrust, Edwin N. Irons, and Cornelius B. Philip. Studies on tsutsugamushi disease (scrub typhus, mite-borne typhus) in New Guinea and adjacent islands: further observations on epidemiology and etiology. Amer. Jour. Hygiene, Baltimore, vol. 41, no. 3, pp. 374–396. May, 1945. (Mammals, p. 379.)

Kraglievich, Lucas J., and Osvaldo A. Reig. Un nuevo roedor extinguido de la subfamilia Hydrochoerinae. Notas Mus. La Plata, vol. 10, paleontol., no. 85, pp. 265–276, figs. 1–3. 1945. (New: *Hydrochoeropsis crespoi*.)

Kritzinger, C. C. Preservation of skins for museum purposes. South African Mus. Assoc. Bull., Natal, vol. 3, no. 12, pp. 351–352. December, 1945.

Lake, Ran. Big land, big game. Alaska Sportsman, Ketchikan, vol. 11, no. 10, pp. 14–15, 29–33, illus. October, 1945. (Grizzly bear, mountain goat.)

Lammon, L. D. When moose were plentiful in Minnesota. Minnesota Div. Bull. Isaac Walton League, 4th Quarter, 1945, p. 17. December, 1945.

Laurent, P. Observations sur les cheiroptères du Midi de la France appartenant à la collection Siepi. Bull. Mus. Hist. Nat. Marseille, vol. 1, no. 4, pp. 290–305. October, 1941.

Laurent-Combaz, Janine. Étude comparative du coeur de l'okapi et d'autres ruminants. Bull. Mus. Roy. Hist. Nat. Belgique, Brussels, vol. 20, no. 15, pp. 1–19, figs. 7. June, 1944.

LAVROV, N. P. Role of helminthic invasions and infectious diseases in number dynamics of Mustela erminea L. Narodnii Komissariat Zagotovok SSSR, Trudy Tsentralnoi Nauch-Issledovatelskoi Laboratorii Biologii, Oxotnichego Promysla i Tovarovedeniia Zhivotnogo Syria, Moscow, no. 6, pp. 151–163. 1944. (In Russian, with English summary.)

LERNER, I. MICHAEL. Lethal and sublethal characters in farm animals. A check-list and proposed numbering system. Jour. Heredity, Washington, vol. 35, no. 7, pp. 219–224. July, 1944.

LIMA, ELADIO DA CRUZ. Mammals of Amazonia. Vol. 1, General introduction and Primates. Contrib. Mus. Paraense Emilio Goeldi Hist. Nat. e Etnografia, Belem do Para and Rio de Janeiro, pp. 1–274, pls. 42. 1945.

LITTLE, C. C., and HELEN MCDONALD. Abnormalities of the mammae in the house mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 285–288, fig. 13. September, 1945.

MAHAFFEY, JUANITA. Coyote round-up. Oklahoma Game and Fish News, Oklahoma City, vol. 1, no. 2, pp. 3–6, 17. January, 1946.

MANN, WALTER G. What has happened to Kaibab deer? Arizona Wildlife and Sportsman, Tucson, vol. 7, no. 1, pp. 10–12. January, 1946.

MANN, F., GUILLERMO. Mamiferos de Tarapacá. Observaciones realizadas durante una expedición al alto Norte de Chile. Biológica, Santiago, fasc. 2, pp. 23–98, figs. 44, pls. 37. July, 1945. (New: *Eligmodontia puerulus tarapacensis*, *Phyllotis osgoodi*, *P. arenarius chilensis*.)

——— Trampa para capturar vivos pequeños mamiferos silvestres. Biológica, Santiago, fasc. 2, pp. 139–140, pl. July, 1945.

MAPLESTONE, P. A., and N. V. BHADURI. Helminth parasites of certain rats in India. Records Indian Mus., Calcutta, vol. 44, pt. 2, pp. 201–206, illus. August, 1942.

MATTHEWS, L. HARRISON. Studies on the biology of the Bristol Channel. VI. The marine mammals of the Bristol Channel. Proc. Bristol Nat. Soc., 4th ser., pt. 2, pp. 231–250. 1940.

MCNUTT, C. W., and P. B. SAWIN. Hereditary variations in the vena cava inferior of the rabbit. Amer. Jour. Anat., Philadelphia, vol. 72, no. 2, pp. 259–289, figs. 1–31, pl. 1. March, 1943.

MEAD, S. W., P. W. GREGORY, and W. M. REGAN. Hereditary congenital flexed pasterns in Jersey cattle. Jour. Heredity, Washington, vol. 34, no. 12, pp. 367–372, figs. 10–12. December, 1943.

MILLER, C. BLACKBURN. Shall we protect the killers? Field and Stream, New York, vol. 50, no. 9, pp. 40–41, 96–97, illus. January, 1946. (Wolves, Dall sheep, reindeer.)

MILLER, RICHARD G. Food habits of Yosemite mammals as indicated by their teeth. Pt. 3. Moles and shrews (Insectivora), bats (Chiroptera). Yosemite Nature Notes, Yosemite, vol. 24, no. 4, pp. 54–56. April, 1945.

——— Food habits of Yosemite mammals as indicated by their teeth. Pt. 4. Even-toed hoofed mammals (Artiodactyla), hares, rabbits, and pikas (Lagomorpha). Yosemite Nature Notes, Yosemite, vol. 24, no. 5, pp. 62–64. May, 1945.

MILLER, RUTH A. Functional and morphological adaptations in the forelimbs of the slow lemurs. Amer. Jour. Anat., Philadelphia, vol. 73, no. 2, pp. 153–183, figs. 1–3. September, 1943.

——— The ischial callosities of primates. Amer. Jour. Anat., Philadelphia, vol. 76, no. 1, pp. 67–91, figs. 1–3, pls. 1–2. January, 1945.

MIROV, N. T. Notes on the domestication of reindeer. Amer. Anthropol., Menasha, n. s., vol. 47, no. 3, pp. 393–408, map. July–September, 1945.

MOHR, CHARLES E. Results of ten years' bat marking in Pennsylvania. Proc. Pennsylvania Acad. Sci., Philadelphia, vol. 16, pp. 32–36. 1942.

——— Sex ratios of bats in Pennsylvania. Proc. Pennsylvania Acad. Sci., Philadelphia, vol. 19, pp. 65–69. 1945.

Mohr, Erna. Ein Fell der Bandrobbe, Histriophoca fasciata Zimm. Zool. Anzeiger, Leipzig, vol. 140, nos. 7–8, pp. 142–143, figs. 1–2. December 1, 1942.

Moore, C. C. Fox hunting for sport and predator control. Game Breeder and Sportsman, New York, vol. 51, no. 1, pp. 3, 8–9. January, 1946.

Moore, Carl R. Prostate gland induction in the female opossum by hormones and the capacity of the gland for development. Amer. Jour. Anat., Philadelphia, vol. 76, no. 1, pp. 1–31, pls. 1–2. January, 1945.

Morrill, E. L. A new sex-linked defect in cattle. Jour. Heredity, Washington, vol. 36, no. 3, pp. 81–82. March, 1945.

Mowery, William Byron. Wee tim'rous white-foot. Nature Mag., Washington, vol. 38, no. 10, pp. 516–519, illus. December, 1945.

Munro, J. A. Preliminary report on the birds and mammals of Glacier National Park, British Columbia. Canadian Field-Nat., Sutton West, vol. 59, no. 6, pp. 175–190, pls. 2. November–December, 1945.

Murie, Olaus J. Fenced wildlife for Jackson Hole. National Parks Mag., Washington, no. 84, pp. 8–11, illus. January–March, 1946.

Murphy, Robert Cushman. Conservation for everybody. School Nature League Bull., New York, ser. no. 12, bull. no. 7, pp. 1–4. March, 1942.

Murray, J. M., and G. D. Snell. Belted, a new sixth chromosome mutation in the mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 266–268, fig. 4. September, 1945.

Nerincx, Edmond. Application de la méthode biométrique et du baguage dans l'étude écologique des cheiroptères. Bull. Mus. Roy. Hist. Nat. Belgique, Brussels, vol. 19, no. 62, pp. 16, figs. 4. December, 1943.

——— Notes sur l'éthologie et l'écologie des cheiroptères de Belgique. Bull. Mus. Roy. Hist. Nat. Belgique, Brussels, vol. 20, no. 19, pp. 24, fig. 1. July, 1944.

Niehuis, Chas. C. Fawn-nappers. The scourge of wildlife. Arizona Wildlife and Sportsman, Tucson, vol. 6, no. 13, pp. 8–10. November, 1945.

Noer, Rudolf J. The blood vessels of the jejunum and ileum: a comparative study of man and certain laboratory animals. Amer. Jour. Anat., Philadelphia, vol. 73, no. 3, pp. 293–334, figs. 1–5, pls. 1–8. November, 1943.

Okada, Yaichirô, and Toshimasa Hanaoka. A study of Japanese Delphinidae (III). *Lagenorhynchus obliquidens* Gill. Sci. Repts. Tokyo Bunrika Daigaku, Tokyo, vol. 4, sect. B, no. 72, pp. 139–157, figs. 5, pls. 12–14. September 25, 1939.

Opler, Morris Edward. Japanese folk belief concerning the cat. Jour. Washington Acad. Sci., vol. 35, no. 9, pp. 269–275. September 15, 1945.

Opler, Morris E., and Robert Seido Hashima. The rice goddess and the fox in Japanese religion and folk practice. Amer. Anthropol., Menasha, n. s., vol. 48, no. 1, pp. 43–53. January–March, 1946.

Owen, Neil W. Softer side of a porcupine. Our Dumb Animals, Norwood, vol. 79, no. 1, p. 7, illus. January, 1946.

Palmer, E. Lawrence. He who runs may be read. Nature Mag., Washington, vol. 38, no. 10, pp. 529–536. December, 1945. (Tracks.)

Palmer, Lawrence J., and Charles H. Rouse. Study of the Alaska tundra with reference to its reactions to reindeer and other grazing. U. S. Dept. Interior, Fish and Wildlife Serv., Research Rept. 10, pp. 48, figs. 20. 1945.

Petersen, W. E., L. O. Gilmore, J. B. Fitch, and L. M. Winters. Albinism in cattle. Jour. Heredity, Washington, vol. 35, no. 5, pp. 135–144, figs. 3–10. May, 1944.

Philip, Cornelius B., and Glen M. Kohls. Studies on tsutsugamushi disease (scrub typhus, mite-borne typhus) in New Guinea and adjacent islands. Tsutsugamushi disease with high endemicity on a small south sea island. Amer. Jour.

Hygiene, Baltimore, vol. 42, no. 2, pp. 195–203, figs. 4. September, 1945. (Mammals as hosts.)

PHILLIPS, JAMES MCILVAINE. "Pig jaw" in cocker spaniels. Retrognathia of the mandible in the cocker spaniel and its relationship to other deformities of the jaw. Jour. Heredity, Washington, vol. 36, no. 6, pp. 177–181, figs. 8–9. June, 1945.

PHILLIPS, RALPH W. The cattle of India. Jour. Heredity, Washington, vol. 35, no. 9, pp. 273–288, figs. 4–11. September, 1944.

——— The water buffalo of India. Jour. Heredity, Washington, vol. 36, no. 3, pp. 71–76, figs. 3–5. March, 1945.

PHILLIPS, RALPH W., and T. Y. HSU. Chinese swine and their performance compared with modern and crosses between Chinese and modern breeds. Jour. Heredity, Washington, vol. 35, no. 12, pp. 365–379, figs. 4–10. December, 1944.

PHILLIPS, RALPH W., RALPH G. SCHOTT, and DAMON A. SPENCER. The multinipple trait in sheep. Jour. Heredity, Washington, vol. 37, no. 1, pp. 19–26, figs. 8–11. January, 1946.

PIEMEISEL, R. L. Natural replacement of weed hosts of the beet leafhopper as affected by rodents. U. S. Dept. Agric., Circ. no. 739, pp. 48, figs. 19. December, 1945.

PLAMONDON, VIGER. Ostéologie cranienne des mammifères carnivores. Rapport Annuel 1945 Société Provancher, Québec, pp. 59–76, figs. 11. 1946.

POCOCK, R. L. External and cranial characters of some rare Asiatic mammals recently exhibited by the Society. Proc. Zool. Soc. London, vol. 115, pts. 3–4, pp. 310–318, fig. 1. February, 1946. (*Rhinoceros, Panthera, Acinonyx, Canis, Mellivora*. New: *Mellivora capensis pumilio*.)

POHLE, HERMANN. Hemitragus jemlahicus schaeferi sp. n., die ostlichste Form des Thars. Zool. Anzeiger, Leipzig, vol. 144, nos. 9–10, pp. 184–191, figs. 1–5. October, 1944. (New: *Hemitragus jemlahicus schaeferi*.)

POPOVA, N. B. Correlation between the skin texture of karakul lambs of robust constitution and various types of the karakul curl. Comptes Rendus (Doklady) Acad. Sci. URSS, Moscow, n. s., vol. 49, no. 1, pp. 55–57. October 10, 1945.

PRICE, DOROTHY. The reactivity of the prostate gland of the female rat in relation to age. Amer. Jour. Anat., Philadelphia, vol. 75, no. 2, pp. 207–231, fig. 1, pl. 1. September, 1944.

RAND, A. L. Mammals of the Ottawa district. Canadian Field-Nat., Sutton West, vol. 59, no. 4, pp. 111–132. July-August, 1945.

——— Lesser known Ottawa mammals. Canadian Field-Nat., Sutton West, vol. 59, no. 4, pp. 133–135. July–August, 1945.

REGAN, W. M., P. W. GREGORY, and S. W. MEAD. Hereditary strabismus in Jersey cattle. Jour. Heredity, Washington, vol. 35, no. 8, pp. 233–234. August, 1944.

RHOAD, ALBERT O., RALPH W. PHILLIPS, and WALKER M. DAWSON. Evaluation of species crosses of cattle by polyallel crossing. A study of zebu and Africander X Aberdeen-Angus cattle under subtropical conditions. Jour. Heredity, Washington, vol. 36, no. 12, pp. 367–374, fig. 7. December, 1945.

RIESE, W. Structure and function of the cerebral cortex in the new-born cat (Felis domestica). Confinia Neurologica, Basel, vol. 7, fasc. 1–2, pp. 55–62, fig. 1. 1946.

ROBERTS, E. Occurrence of red-eye in swine. Jour. Heredity, Washington, vol. 36, no. 7, pp. 207–208, figs. 6–7. July, 1945.

ROBERTS, E., and C, C, MORRILL. Inheritance and histology of wattles in swine. Jour. Heredity, Washington, vol. 35, no. 5, pp. 149–151, figs. 13–14. May, 1944.

ROBYNS, W. Note écologique sur quelques bains d'éléphants au Congo belge. Bull. Inst. Roy. Colonial Belge, Brussels, vol. 12, no. 2, pp. 318–327, figs. 1–2. 1941.

ROCHESTER, T. E. What about our beavers? Arizona Wildlife and Sportsman, Tucson, vol. 6, no. 13, p. 6. December, 1945.

RODE, P. Catalogue des types de mammifères du Muséum National d'Histoire Naturelle. Ordre des rongeurs. Bull. Mus. Nat. Hist. Nat., Paris, ser. 2, vol. 17, no. 3, pp. 201–208, April, 1945; no. 4, pp. 292–300, May 1945.

ROPER, HARTWELL E. A farmer looks at wildlife management. Pennsylvania Game News, Harrisburg, vol. 16, no. 9, pp. 4–5, 25. December, 1945.

ROSCOE B. JACKSON MEMORIAL LABORATORY, STAFF OF THE. A chromosome map of the mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 271–273, fig. 5. September, 1945.

RUSCONI, CARLOS. Nueva especie de Megaterio de Mendoza. Bol. Soc. Geol. Peru, Lima, vol. 18, pp. 3–9, figs. 3. July 4, 1945. (New: *Paramegatherium incognitum.*)

——— Caballos petisos y enanos. Suelo Argentina, Año 4, no. 47, pp. 16–18, 20–23, 45, illus. November, 1945.

——— Varias especies de roedores del Puelchense de Buenos Aires. Anal. Soc. Cient. Argentina, vol. 140, pp. 369–376, figs. 6. November, 1945. (New: *Isostylomys laevis, Diaphoromys arctus, Gyriabrus latidens, Myocastor brevirostris ballesterensis, Tramyocastor majus.*)

——— Presencia de mamíferos terciarios en San Juan. Publ. Inst. Fisiografia y Geol., Rosario, no. 25, pp. 1–10, figs. 3. 1946. (New: *? Hegetotherium arctum, Asterostemma barrealense.*)

——— Nuevo mamífero fósil de Mendoza. Bol. Paleont. Buenos Aires, no. 20, pp. 2, figs. 2. April 6, 1946. (New: *Allalmeia, A. atalaensis.*)

RUSH, WILLIAM. When animals get sick. Amer. Forests, Washington, vol. 52, no. 1, pp. 24–26, 48, illus. January, 1946.

SAWIN, PAUL B., and INEZ BAUMGARTNER HULL. Morphogenetic studies of the rabbit. II. Evidence of regionally specific hereditary factors influencing the extent of the lumbar region. Jour. Morphol., Philadelphia, vol. 78, no. 1, pp. 1–26. January, 1946.

SAWIN, P. B., C. A. STUART, and K. M. WHEELER. Pictorial presentation of antigen and antibody relations associated with the "A" character in the rabbit. Jour. Heredity, Washington, vol. 34, no. 6, pp. 179–186, figs. 13–17. June, 1943.

SCHANTZ, VIOLA S. A new badger from South Dakota. Proc. Biol. Soc. Washington, vol. 59, pp. 81–82. June 19, 1946. (New: *Taxidea taxus dacotensis.*)

SCHEFFER, PAUL M., and RICHARD M. BOND. A problem of "antler room." Soil Conserv., Washington, vol. 11, no. 7, pp. 161–166, illus. January, 1946.

SCHOLANDER, P. F. A micro-gas-analyzer. Rev. Sci. Instruments, Menasha, vol. 13, no. 6, pp. 264–266, figs. 2. June, 1942.

——— Microgasometric determination of nitrogen in blood and saliva. Rev. Sci. Instruments, Menasha, vol. 13, no. 8, pp. 362–364, fig. 1. August, 1942.

SCHOLANDER, P. F., and G. A. EDWARDS. Volumetric microrespirometer for aquatic organisms. Rev. Sci. Instruments, Menasha, vol. 13, no. 7, pp. 292–295, fig. 1. July, 1942.

SCHOLANDER, P. F., NIELS HAUGAARD, and LAURENCE IRVING. A volumetric respirometer for aquatic animals. Rev. Sci. Instruments, Menasha, vol. 14, no. 2, pp. 48–51. February, 1943.

SCHOLANDER, P. F., and LAURENCE IRVING. Experimental investigations on the respiration and diving of the Florida manatee. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 17, no. 2, pp. 169–191, figs. 15. April, 1941.

SCHOLANDER, P. F., LAURENCE IRVING, and S. W. GRINNELL. Aerobic and anaerobic changes in seal muscles during diving. Jour. Biol. Chemistry, Baltimore, vol. 142, no. 1, pp. 431–440, figs. 4. January, 1942.

——— Respiration of the armadillo with possible implications as to its burrowing. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 21, no. 1, pp. 53–63, figs. 3. February, 1943.

SCHOLANDER, P. F., and F. J. W. ROUGHTON. A simple micro-gasometric method of estimating carbon monoxide in blood. Jour. Industrial Hygiene and Toxicology, Cambridge, vol. 24, no. 8, pp. 218–221. October, 1942.

SCHOONMAKER, WALTER J. The white-tailed deer through the year. Nature Mag., Washington, vol. 39, no. 1, pp. 25–30, illus. January, 1946.

SCHREDER, V. N. Physico-chemical analysis of the physiology of spermatozoa of Mammalia. Communication 10. Spermatoxine and question of artificial sex differentiation in Mammalia. Bull. Acad. Sci. URSS, Moscow, biol. ser., 1945, no. 4, pp. 404–418. 1945. (In Russian, with English summary.)

SCHREUDER, A. A revision of the fossil water-moles (Desmaninae). Archiv. Néerlandaises Zool., Haarlem, vol. 4, livr. 3–4, pp. 201–333, figs. 99, pls. 11. 1940. (New: *Mygalea, Mygalinia, Desmana pontica, D. kormosi, D. moschata moravica.*)

——— Verspreiding en voorgeschiedenis der niet algemeene Nederlandsche muizen. Zool. Mededeel., Leiden, vol. 25, pp. 239–284, figs. 11. 1945.

SCOTT, WALTER J., LAURENCE IRVING, and VIRGINIA SAFFORD. Characteristics for the transport of oxygen by the blood of mink and marten. Jour. Cell. and Comp. Physiol., Philadelphia, vol. 14, no. 3, pp. 281–286, figs. 2. December 20, 1939.

SEAGEARS, CLAYTON B. The fox in New York. Western New York Conservationist, Buffalo, vol. 5, no. 10, p. 5. November, 1945.

SELL, FRANCIS E. Readin' sign. Field and Stream, New York, vol. 50, no. 8, pp. 49, 100–102, illus. December, 1945.

SENÔ, JIRÔ. On two specimens of porpoise captured off the coast of Ozernaya, Kamchatka. Bull. Japanese Soc. Sci. Fisheries, Tokyo, vol. 8, no. 6, pp. 357–364, figs. 12 (1 map). March, 1940. (In Japanese with English synopsis. *Phocaenoides dalli* True.)

SHANKLIN, WILLIAM M. Histogenesis of the pig neurohypophysis. Amer. Jour. Anat., Philadelphia, vol. 74, no. 3, pp. 327–353, pls. 1–5. May, 1944.

SHOLOKHOV, V. A. Age variation of the skin of karakul sheep. Comptes Rendus (Doklady) Acad. Sci. URSS, Moscow, n. s., vol. 49, no. 1, pp. 58–61. October 10, 1945.

SHORTT, T. M. Arctic mammals. Canadian Nat., Toronto, vol. 8, no. 1, pp. 12–13. January, 1946.

SLATER, DANIEL W., and ERNST J. DORNFELD. Quantitative aspects of growth and oocyte production in the early prepubertal rat ovary. Amer. Jour. Anat., Philadelphia, vol. 76, no. 2, pp. 253–275, figs. 1–3, pls. 1–2. March, 1945.

SMELSER, GEORGE K. A study of retrobulbar tissues in experimental exophthalmos in guinea pigs with reference to primary and secondary modifications. Amer. Jour. Anat., Philadelphia, vol. 72, no. 2, pp. 149–169, pls. 1–2. March, 1943.

SMITH, SEDGWICK E. Another case of a black-blue mosaic in the Dutch rabbit. Jour. Heredity, Washington, vol. 35, no. 11, pp. 325–326, fig. 3. November, 1944.

SMITH, SEDGWICK E., and B. F. BARRENTINE. Hereditary cataract. A new dominant gene in the rat. Jour. Heredity, Washington, vol. 34, no. 1, pp. 8–10, fig. 5. January, 1943.

SNELL, G. D. The detection of mutations. Relative efficiency of various systems of brother-sister inbreeding of mice. Jour. Heredity, Washington, vol. 36, no. 9, pp. 275–278, figs. 6–8. September, 1945.

——— Linkage of jittery and waltzing in the mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 279–280, fig. 9. September, 1945.

STEGGERDA, MORRIS. Animal traps and snares used by the Maya Indians of Yucatan, Mexico. Amer. Anthropol., Menasha, n. s., vol. 46, no. 2, pt. 1, pp. 269–272, pl. 1. April-June, 1944.

STILWELL, HART. Queer deer. Field and Stream, New York, vol. 50, no. 8, pp. 23–25, 86, 89, illus. December, 1945.

STONAKER, H. H. The breeding structure of the Aberdeen-Angus breed. Jour. Heredity, Washington, vol. 34, no. 11, pp. 322–328, figs. 1–3. November, 1943. (Cattle.)

STONAKER, H. H., and R. C. TOM. "Compact" shorthorns. Jour. Heredity, Washington, vol. 35, no. 8, pp. 247–250, fig. 12. August, 1944. (Cattle.)

SURRARRER, T. C. Bulldog and hairless calves. Jour. Heredity, Washington, vol. 34, no. 6, pp. 175–178, figs. 7–12. June, 1943.

SWANSON, PAUL L. Nature's straphanger. Fauna, Philadelphia, vol. 7, no. 4, pp. 104–108, illus. December, 1945. (Sloth.)

TAYLOR, WALTER P. The biologist and the war. Audubon Mag., New York, vol. 45, no. 2, pp. 71–76. March-April, 1943.

TERAO, ARATA. Microscopical examination of the leather of aquatic animals. Bull Japanese Soc. Sci. Fisheries, Tokyo, vol. 8, no. 6, pp. 343–346. March, 1940. (In Japanese with English summary. Includes *Zalophus*, *Delphinus*, *Physter*, and *Balaenoptera*.)

THOMASON, HUGH. Drama in the grasslands. Fauna, Philadelphia, vol. 7, no. 4, pp. 99–103, illus. December, 1945. (Leopard.)

TOMILIN, A. G. The age of whales as determined from their baleen apparatus. Comptes Rendus (Doklady) Acad. Sci. URSS, Moscow, n. s., vol. 49, no. 6, pp. 460–463, figs. 2. November 30, 1945.

TREAT, DOROTHY A. Track stories in mud, sand, and snow. School Nature League Bull., New York, ser. 16, bull. 4, pp. 4 (not numbered). December, 1945.

TRINGLEY, V. E. Allegheny fur trails. Fur-Fish-Game (Harding's Mag.), Columbus, vol. 79, no. 1, pp. 30–31. January, 1946.

TROUGHTON, ELLIS. Diagnoses of new mammals from the south-west Pacific. Records Australian Mus., Sydney, vol. 21, no. 6, pp. 373–375. June 25, 1945. (New: *Echymipera philipi*, *Petaurus kohlsi*, *Rattus owiensis*, *Rattus browni gawae*, *Rattus rennelli*.)

——— Diagnoses of new rats from the New Guinea area. Records Australian Mus., Sydney, vol. 21, no. 7, pp. 406–410. June 24, 1946. (New: *Rattus ringens dobodurae*, *R. gestri bunae*, *R. purdiensis*, *R. sansapor*, *R. biakensis*.)

TRYON, C. A., JR. The great gray owl as a predator on pocket gophers. Wilson Bull., Ann Arbor, vol. 55, no. 2, pp. 130–131. June, 1943.

URBAIN, ACH., J. NOUVEL, and P. BULLIER. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes en 1944. Bull. Mus. Nat. Hist. Nat., Paris, ser. 2, vol. 17, no. 3, pp. 209–220. April. 1945.

VAN ATTA, C. E. Notes on the former presence of grizzly and black bears in Marin County, California. California Fish and Game, San Francisco, vol. 32, no. 1, pp. 27–29. January 2, 1946.

VAN DEN BERGHE, L., and G. BONÉ. De la parenté sérologique de l'okapi et de la girafe. Bull. Classe Sci. Acad. Roy. Belgique, Brussels, ser. 5, vol. 30 (1944), nos. 4–6, pp. 239–244. 1945.

VAN DYKE, JOHN H. Behavior of ultimobranchial tissue in the postnatal thyroid gland: epithelial cysts, their relation to thyroid parenchyma and to "new-growths" in the thyroid gland of young sheep. Amer. Jour. Anat., Philadelphia, vol. 76, no. 2, pp. 201–251, figs. 1–7, pls. 1–4. March, 1945.

VOIGT, WILLIAM, JR. Is the bighorn doomed? Outdoor America, Chicago, vol. 11, no. 2, pp. 10, 11, illus. January-February, 1946.

WALLACE, TOM. Skunk sense. Nature Mag., Washington, vol. 39, no. 1, p. 47, illus. January, 1946.

WARWICK, E. J., A. B. CHAPMAN, and BURR ROSS. Some anomalies in pigs. Jour. Heredity, Washington, vol. 34, no. 11, pp. 349–352, figs. 13–14. November, 1943.

WEIDENREICH, FRANZ. The "Neanderthal man" and the ancestors of "*Homo sapiens*." Amer. Anthropol., Menasha, n. s., vol. 45, no. 1, pp. 39–48, fig. 1. January-March, 1943.

WHITE, DALE. Transplanting Rocky Mountain goats. Nat. Hist., New York, vol. 55, no. 1, pp. 20–23, illus. January, 1946.

WHITE, THEODORE E. The Lower Miocene mammal fauna of Florida. Bull. Mus. Comp. Zool., Cambridge, vol. 92, no. 1, pp. 1–49, pls. 1–14. November, 1942. (New:

*Daphaenus caroniavorus, Paradaphaenus tropicalis, Amphicyon longiramus, Nothocyon insularis, Hypermekops, H. olseni, Paraphippus barbouri.*)

WILLIAMS, ROY G. Some properties of living thyroid cells and follicles. Amer. Jour. Anat., Philadelphia, vol. 75, no. 1, pp. 95–119, fig. 1, pl. 1. July, 1944. (Laboratory rats and mice.)

——— The characteristics and behavior of living cells in autogenous grafts of adrenal cortex in rabbits. Amer. Jour. Anat., Philadelphia, vol. 77, no. 1, pp. 53–79, figs. 1–5, pls. 1–2. July, 1945.

WIMSATT, WILLIAM A. An analysis of implantation in the bat, Myotis lucifugus lucifugus. Amer. Jour. Anat., Philadelphia, vol. 74, no. 3, pp. 355–411, pls. 1–7. May, 1944.

——— The placentation of a vespertilionid bat, Myotis lucifugus lucifugus. Amer. Jour. Anat., Philadelphia, vol. 77, no. 1, pp. 1–51, figs. 1–2, pls. 1–7. July, 1945.

WISLOCKI, GEORGE B., and H. STANLEY BENNETT. The histology and cytology of the human and monkey placenta, with special reference to the trophoblast. Amer. Jour. Anat., Philadelphia, vol. 73, no. 3, pp. 335–449, fig. 1, pls. 1–13. November, 1943.

WISLOCKI, GEORGE B., and EDWARD W. DEMPSEY. Histochemical reactions in the placenta of the cat. Amer. Jour. Anat., Philadelphia, vol. 78, no. 1, pp. 1–45, pls. 1–4. January, 1946.

WOOLLEY, GEORGE W. Misty dilution in the mouse. Jour. Heredity, Washington, vol. 36, no. 9, pp. 269–270. September, 1945.

WOOLLEY, GEORGE W., and MARGARET M. DICKIE. Pirouetting mice. Jour. Heredity, Washington, vol. 36, no. 9, pp. 281–284, figs. 10–12. September, 1945.

WORMINGTON, H. M. Jesse Dade Figgins, 1867–1944. Amer. Anthropol., Menasha, n. s., vol. 48, no. 1, pp. 75–77. January–March, 1946.

WRIGHT, EARL G. Mistaking the hawk. Passenger Pigeon, Madison, vol. 7, no. 4, p. 127. October, 1945. (Weasel and *Microtus* eaten by roughleg hawk.)

WRIGHT, W. H. DEC. Fox: Not as black as painted. Ralley Sheet, League of Maryland Sportsmen, Baltimore, vol. 4, no. 1, pp. 6, 8. January, 1946.

## COMMENT AND NEWS

### NOTICE OF ANNUAL MEETING

The Twenty-seventh Annual Meeting of the American Society of Mammalogists will be held August 24–27, 1947, at Higgins Lake, Michigan. The Society will be the guest of the Michigan Department of Conservation at the Department's Field School on Higgins Lake. In the evening of August 24 the Directors of the Society will assemble for a business meeting. Formal sessions for all members will begin on August 25. Because sleeping and mess accomodations at the School are limited, the local committee must know well in advance of the meetings how many expect to attend, and the mammalogists should plan to leave the school on August 27, to make way for the Society of Icthyologists and Herpetologists which will assemble there August 28–30.

In March, each member will be requested, by postal card, to supply certain information regarding accomodations and transportation. To insure quarters for yourself and family in the vacationland of Michigan at the peak of the vacation period, be certain to respond before the deadline as given on the card. For additional information please see the May issue of the Journal or contact the chairman of the Local Committee on Arrangements, Dr. William H. Burt, University of Michigan Museum of Zoology, Ann Arbor, Michigan.

EDITOR, JOURNAL OF MAMMALOGY:

From a letter of June 27, 1946, from Prof. Dr. Hermann Pohle, Curator of Mammals in the Berlin Zoological Museum, it is learned that he, his wife, and children all survived the

war. The two translated paragraphs below give accurate information about the museum which houses one of the world's three largest collections of mammals.

Now something about our museum and collections. We had, I might say fortunately, moved scarcely anything out of Berlin. Only our library was sent away; 166 boxes were placed in Oderbruch and 50 in Württemberg. Of the 166 boxes 150 were brought back in the nick of time by Prof. Stresemann; the remainder were burned there. The other 50 boxes are still in Württemberg.

As for the rest, we were only able to move our materials out of the upper stories into the cellar, and there nothing has as yet happened to them. Only material which remained above was destroyed, altogether it may be somewhere around 10 percent, which however was distributed among various departments. The mammal division may have been 5 percent destroyed. The "Wurmabteilung" had the greatest loss, somewhere around 40 percent. The building has suffered much worse; the entire wing where the library and the alcohol-room of the mammal division was situated was destroyed by a 1000 pound bomb, the songbird-hall was hit by three 100 pound bombs, one reptile hall was annihilated by fire bombs, and so forth. Worse, however, than the direct damage by the bombs is the water which came in consequence of the bombs. The roofs are partly burned, partly perforated by the grenades and the rain now runs through in little streams into the floors below, soaking everything and thereby destroying more than the bombs. Of course we seek to help matters as much as we possibly can but that goes very slowly because of lack of materials.—E. Raymond Hall.

### LANE NEEDS KODACHROMES

Frank W. Lane is preparing a book on World Mammals and is anxious to get in touch with anyone who has kodachromes of non-American mammals. He may be reached at Chipperfield, 116 Evelyn Avenue, Ruislip Middx., England.

### INTERNATIONAL WHALING CONFERENCE MEETS IN WASHINGTON

From November 20 to December 2, 1946, the State Department of the United States Government was guest to about twenty Nations at an international whaling conference in Washington, D. C. Chairman of the conference and head of the United States delegation was Dr. Remington Kellogg, Curator of Mammals, U. S. National Museum, and President of the American Society of Mammalogists. Dr. Kellogg has been associated with international whaling conferences since the Berlin League of Nationas Conference in 1930, which resulted in the Geneva Convention of 1931. Dr. Ira N. Gabrielson, President of the Wildlife Management Institute and past director of the U. S. Fish and Wildlife Service, was vice-chairman and the second United States delegate. The third delegate was Dr. William E. S. Flory, acting Chief, International Resources Division, Department of State. Advisors to the U. S. delegations were Dr. Hillary J. Deason, chief of the Division of Foreign Activities, U. S. Fish and Wildlife Service, and Dr. Raymond M. Gilmore, also of the Division of Foreign Activities and in charge of whale research.

The conference aimed primarily at the codification of international agreements now in force into a single convention and the establishment of an International Whaling Commission. The other urgent matter before the conference was the conservation of the already depleted whale populations of the world in the face of heavily increased world demands for more fats and oils. Whale oil is the principal ingredient of butter substitutes in Europe. Ratification by all signatory governments will be necessary to bring the 1946 International Whaling Convention into force.

### ANTHONY RETURNS FROM AFRICA

Dr. Harold E. Anthony, Curator of Mammals, American Museum of Natural History, New York, returned in early November 1946 from an expedition to Nyassaland, South Africa. This expedition, financed and led by Sir Arthur Vernay, left New York on May 8, 1946, and spent about six months carrying on research and making collections of mammals

and plants for the Museum. The botanical collections were made by Mr. Leonard Brass, botanist of the Archbold New Guinea Expeditions. Sir Arthur Vernay is well known as a friend and patron of the Museum and for his extensive expeditions to India.

### HERSHKOVITZ RESUMES STUDIES AT U. S. NATIONAL MUSEUM

Philip Hershkovitz returned recently from the European Theater of War to resume his studies of mammals under the Walter Rathbone Bacon Traveling Fellowship at the U. S. National Museum. Before the war, he carried out field studies on mammals on this scholarship in northeastern Colombia between the Magdalena River and Venezuela.

### HATFIELD LEAVES CHICAGO ACADEMY OF SCIENCES

Dr. Donald M. Hatfield, who until recently held the position of Curator of Mammals at the Chicago Academy of Sciences, has resigned to take up work on educational movies in Hollywood. Hatfield received his training in vertebrate zoology at the Museum of Vertebrate Zoology, University of California, Berkeley. His work on mammals covered many subjects but was related principally to microtine rodents. When the war interrupted his activities, he was revising the red-backed mice of the eastern United States.

### DR. ANDERSON RETIRES

Dr. Rudolph M. Anderson, for the past 25 years Chief, Division of Biology, National Museum of Canada, Ottawa, was retired on superannuation June 30, 1946. He has recently been appointed Honorary Curator in Mammalogy in the same institution and expects to continue with his research work. He is expecting the publication soon of his "Catalogue of Canadian Recent Mammals." "Andy" requests that his correspondents address him at 58 Driveway, Ottawa.

### GUNTER IN FLORIDA

Dr. Gordon Gunter is acting as Visiting Professor in the Department of Zoology and Research Associate in the Marine Laboratory of The University of Miami. He is working on the Florida spiny lobster investigations and will teach marine ecology and the biology of fishes. He is on leave of absence from the Institute of Marine Science of The University of Texas.

### A PROTEST

EDITOR, JOURNAL OF MAMMALOGY:

I have read with deep regret the paper on "Zoological Subspecies of Man at the Peace Table" by E. R. Hall (Jour. Mamm., vol. 27, no. 4, pp. 358-364). I do not think that mankind or the task of peacemaking will profit from the publication of this discussion.

Although the recognition of "subspecific" differences between the "races" of man may be justifiable, it is unwarranted to stress "the magnitude of these differences." They are all on the somatic level and the infinitely more important question of the existence or nonexistence of mental differences is not even raised. That man is subject to the laws of biology is evident. But there is considerable evidence that he has evolved to a new level where additional modifying laws come into play. Simply to substitute zoology for sociology is surely not the way to a clarification of this question.

That species or subspecies "native to a larger land mass" prevail in competition with others is a conclusion which is not substantiated by the available evidence. The few observations quoted by the author can be explained in quite different ways. To base far reaching political and international suggestions on such an hypothesis can achieve only one end: to provide "scientific" material with which prejudice can support and rationalize its insiduous propaganda.

Scientists claim rightly a place in the councils of the world. But they will have to think more of the gigantic responsibility entailed in the granting of their requests.—H. SICHER, *School of Dentistry, Loyola University, Chicago 12, Illinois.*

## A ZOOLOGIST LOOKS AT RACIOLOGY: A REPLY TO DR. E. RAYMOND HALL'S "ZOOLOGICAL SUBSPECIES OF MAN AT THE PEACE TABLE"

At the 1946 meeting of the American Society of Mammalogists Dr. Hall read a paper with the above title, which was recently published in the *Journal of Mammalogy* (vol. 27, no. 4). A number of his colleagues, including myself, cannot subscribe to his views, although careful consideration has been given to them. I heartily agree with the implication of the title that a more thorough understanding of human races or subspecies, of why and how antagonisms arise between them, could do much toward a lasting peace. The factors involved in racial and cultural conflict are similar to those causing war. Such a study of human relations, in my opinion, is urgently needed and should be pursued with at least the same vigor and financial support as the search for new and more deadly weapons. Unfortunately this paper does not contribute anything to these ends, and the arguments presented are not those that might assist a peace conference. The Allied Powers are not convening on this occasion to divide up Russia, to order the several Siberian and Caucasian republics to be separated from the European republics. Delegates will not be called upon to set aside Mississippi and Alabama as a homeland for denaturalized American negroes. The terms of a treaty with Japan will hardly include articles requiring the deportation of thousands of Americans of Japanese ancestry, many of whom rendered invaluable service to us in the war and against none of whom was proved any disloyal act. These and similar actions are the logical outcome of his thesis.

This thesis seems to imply that one important cause of war is the living together of different kinds of peoples. Do barriers set up between people make for friendly relations? If that were so, the Balkan States with their fierce nationalism would have been a breeding-ground for peace!

On the contrary, historical experience indicates that segregation leads to strife. Barriers have been set up between different peoples frequently in the past, and even when the peoples differ in minor details, sometimes only in language, friction generally resulted. Hate flourishes best in an atmosphere of ignorance, where the stereotype, that warped idealized version of the other group, robbed of all humane characters, can be set up as a target. As we have seen in recent years, the first step in teaching war is to destroy the appreciation of a common human nature shared by other groups. Remove the belief in a common humanity and it is relatively more simple for men to kill others.

Dr. Hall's paper applies not to a peace conference but to a domestic matter and is an implied appeal for a constitutional amendment, restricting American citizenship to persons of the white "subspecies." How such an amendment would appear to people abroad who have just emerged from under the domination of Nazi Germans is a question we are not concerned with here, but it is doubtful if it would strengthen their faith in the idealisms this country often professes, and it is doubtful if peace would be greatly strengthened in consequence.

Dr. Hall very conservatively recognized five subspecies of man, and he distinguishes between the category of "race" and "subspecies." This is a distinction he sets up himself, then assumes that all zoologists agree with him. In some places he seems to use "race" in the place of "nationality," in others as a subdivision of a "subspecies" recognizable on statistically significant characters, the individuals of "races" not always recognizable. Groups of mankind belonging to these two categories may exist, divisions comparable to the subspecies of mammals and others perhaps like local populations. Although several more subspecies of man seem recognizable than Dr. Hall lists, the statement that there are subspecific groups has perhaps less in it to criticize from my point of view than the rest. No one but a "strawman" denies the existence of differences among mankind. That certain groups cannot be assigned satisfactorily is not unexpected; mammalian specimens are often secured that can be properly identified only as to species.

There is a serious fallacy in the assumption that "subspecies" is a real thing; it is a derived concept or generalization and so is at least one degree removed from reality. This explains why various systematists do not agree on what specimens can be referred to one or

another subspecies, why some students recognize more, others fewer, subspecies in both other mammals and mankind.

It is dangerous to base arguments on analogy, as dangerous when the analogy is between social situations in man and purely biological reactions, as it would be to argue from chemical or physical analogies. Learning is assisted by reference to analogy, the trait of drawing attention to parallel phenomena in other fields is deeply ingrained in human experience (*e. g.*, the parables of Jesus), but there is a tendency for arguers to seek support from analogy which it cannot give.

A fallacy of this nature, cruder but basically similar to Dr. Hall's reasoning on the subject, may be illustrative: "Many Old World monkeys live in family troops in which the patriarch rules autocratically, therefore dictatorship is the only natural system for human society." Support for any system of philosophy, no matter how absurd, can be drawn in this fashion from natural phenomena. But much of our life as civilized human beings is contrary to parts of our nature. Man is so modified by education and other social forces that his behavior is not directly comparable to that of the so-called lower mammals. Even were the biological premises here indisputable, analogies drawn therefrom would not make a compelling argument.

It is necessary to agree first on definitions. Subspecies of mammals, in my understanding, are geographical groups, the majority (say 75 percent or more) of which can be separated from populations of the same species in other geographical areas. This is a definition with which most systematists are in agreement, and Dr. Hall's systematic work seems predicated on the same concept. To argue from this definition that two subspecies never occur in the same geographic area ia arguing in circles. That because two subspecies generally occupy different geographical areas the major types of mankind must exclude each other is weak on biological grounds as well as in logic. Individual deer mice, for instance, that would be, on a basis of color or other grounds, placed in two or more subspecies, frequently occur together and often over rather large areas. Because they interbreed freely and much of the population that results is in consequence somewhat intermediate in characters, the individual specimens from these areas of intergradation may not be referred to the subspecific group they most resemble.

When through such intergrading populations a long chain of subspecies results (subspecies A intergrading with subspecies B; B, with C; C, with D, and so forth), the extremes of the chain may be quite different in size or appearance. Should these extreme groups overlap in range, they may behave toward each other as if they were full species and not interbreed. As a rule they occupy somewhat different ecological habitats and have distinctive habits. Such overlapping distribution of differentiated subspecies of mammals without blending is not a rare phenomenon.

Competition between groups of mammals may occur when two biologically distinct populations are thrown together and both have the same ecological preferences. But such competition is far different from competition among different groups of men!

Another instance where analogy is used by Dr. Hall to establish a social principle involves the generalization that when two kinds of mammals are thrown together in competition, the one native to the largest land mass prevails. This is only vaguely supported by evidence and applies chiefly to island species which have a background of long isolation and the extinction of such mammals when exposed to the competition of species with ecologically similar needs which had a history of severe competition. The Australian fauna is perhaps the best example, and its disappearance before the introduced cats, foxes and rabbits. Even the fact that more Eurasian types of mammals successfully invaded North America during the Pliocene and Pleistocene than emigrated from this continent does not adequately explain the taking over of the New World by the European invaders of the past several centuries. Many other factors enter into the causes of success or failure and the correlation of lesser area with lesser ability to survive is too tenuous in relation to mankind to require serious consideration. Tentative hypotheses are not valid arguments for major political action.

The familiar bugaboo of the "higher birthrate" of alien peoples is brought into the argument in spite of the fact that no scientific proof has ever been advanced that establishes differential fertility between races or "subspecies." Americans, it is true, seem to prefer automobiles to babies. That general cultural pattern seems to follow better living standards and city life, while poverty and rural living seem correlated with large families. The standards we have developed are perhaps dangerous ones in the long run to our culture but that can be remedied only by a change in our system of values.

There are many biological generalizations that have importance in human affairs but if men lived uninfluenced by other considerations than biology, there would quite probably be no racial question at all. Minority groups would be absorbed into the common stock in a very short time. Would this be deleterious? Perhaps, but plant and animal breeders continually seek to improve organisms with which they work by crossing various breeds and selecting from the variable offspring those that combine desirable characters. It is possible that the biological mixing which occurs in nature explains some of the hardihood shown by continental animals as compared with isolated populations such as may occur on islands. Dr. Hall produces no zoological evidence that subspecific interbreeding is deleterious; again it is a social, not a biological question.

When social prejudices do not rule, in Brazil, in Hawaii, and in many other places, mixture of "subspecies" has gone on without loss of health, intelligence, stamina, or similar injurious effects on the population. There is considerable evidence that modern Europeans are the product of interbreeding of as different peoples as any modern "subspecies" of man. The belief in the evils of such mixture is not far removed from faith in myths and has no other basis than the subconscious or conscious supposition of one's own racial superiority.

There is nothing novel in these ideas of exclusivism. Other biologists, as well as business men and workers, have held them in the past. Prejudice itself is perhaps a personal right, but when it is panoplied in scientific language and seeks to draw its support from a scientific field, intellectual integrity demands of people in that field an adequate reply.—JOHN ERIC HILL, *American Museum of Natural History, New York.*

FURTHER PROTEST

I read Prof. Hall's article, "Zoological Subspecies of Man at the Peace Table" (Jour. Mamm. vol. 27, no. 4; pp. 358–64, 1946) with mingled incredulity and dismay, the former that a meeting of scientists endorsed the article on April 18, 1946 (even though in a footnote the Editor disavows Society responsibility), the latter that such a social philosophy should be represented to the U. N. as typical of American scientific thinking. In my opinion the article is poor Anthropology bolstered by doubtful zoological (infra-human) analogies.

Prof. Hall lists five subspecies of Man, *H. s. sapiens*, *H. s. americanus*, *H. s. asiaticus*, *H. s. afer*, and *H. s. tasmanianus*. I know of no current physical anthropologist who classes the Amerind as a separate subspecies. Today we tend to recognize three major subspecies: Caucasoid, Mongoloid, Negroid, with a possible fourth, i.e., the Australian aborigines as "Archaic Caucasoid." I am holding no brief for terminology *per se*, but in deference to usage I suggested in 1943 (Sci. Mo., Aug., pp. 97–104) that we employ *H. s. caucasoideus*, *H. s. mongoloideus*, and so on.

In his classification Prof. Hall implies a prejudice which ranks the Caucasian as superior. Why, pray, tell, are we *H. s. sapiens* (presumably the wisest of the wise) when all others receive geographic subspecific recognition? Why are we the protoype of Mankind? In all consistency *H. s. sapiens* should, in Prof. Hall's system, be given as *H. s. europaeus*.

Prof. Hall's insistence upon the absolutely clear-cut nature of subspecific differences in Man is shared neither by modern physical anthropologists nor by some of his zoological colleagues. I refer him, respectfully, to my chapter "The Concept of Race" in Linton's recent volume ("The Science of Man in the World Crisis," Col. U. Press., 1945, see espec. pp. 38–62). I refer him further to Kinsey's statement (Amer. Nat., vol. 71, pp. 206–22, 1937) that a species is "the unit beneath which there are in nature no subdivisions which maintain themselves for any length of time over a large area."

Prof. Hall refers to subspecific physiological differences in Man, citing the oft-abused

"racial odor" theme. I would wish to see his evidence that body odor is really "racial" (and hence heritable), rather than a function of cleanliness (remember, Lifebuoy advertises to both whites and Negroes) and diet (did Prof. Hall ever get the windward of a group of garlic-eaters?). No, I fear that here race must take a backseat to cultural habits.

I was intrigued by the "extinction by dilution" argument with moose, mice, reindeers and caribou parading through time and across space. The evidence here, at purely zoological level, is impressive. But Man is more than a zoological migrationist. The argument that the Orientals from a larger land mass may do to us what we did to the American Indians disregard completely the vast difference in cultural level between the invading Europeans and the American Aborigines. Prof. Hall gives us a 50–50 chance today because we are of relatively recent Asiatic origin (western one-half of the Eurasiatic land mass). This strikes me as circular reasoning: we can resist an Oriental invasion because we are substantially Oriental ourselves.

The crux of Prof. Hall's argument is to limit Oriental migration, to deny them citizenship, and, if necessary to deport the "invaders" already here, who "have a higher birth rate and who are of another subspecies." His arguments which are based upon what I consider inadequate Anthropology and doubtful analogy, reduce, finally, to rank, undemocratic prejudice. A biological and spiritual isolationism is represented here that to me is basic to a "master-race" concept. What he argues for subspecies can easily be carried over, popularly, for nationality, religion, or what have you.

I beg Prof. Hall, and those who endorsed his article, not to provide material which a future Rosenberg may indoctrinate into a future "Mein Kampf.—"WILTON MARION KROGMAN, *University of Chicago.*

---

NOTICE

The issues of Volume 27 were issued as follows:

VOL. 27, NO. 1, MARCH 14, 1946
VOL. 27, NO. 2, MAY 14, 1946
VOL. 27, NO. 3, AUGUST 14, 1946
VOL. 27, NO. 4, NOVEMBER 25, 1946

**INDEX TO JOURNAL OF MAMMALOGY**

**NOW AVAILABLE**

The index to the first 20 volumes, 1919–1939 inclusive, of this journal are now on sale. Paper covers, $2.50; cloth, $3.50.